ECONOMIC AND BENEFITS ANALYSIS OF THE PROPOSED

SMALL VESSEL GENERAL PERMIT (SVGP)

Office of Wastewater Management

U.S. Environmental Protection Agency

November 30, 2011

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Abbreviations

ADEC	Alaska Department of Environmental Conservation
AFS	Antifouling hull system
ANS	Aquatic non-indigenous species
BMP	Best management practice
BOD	Biochemical oxygen demand
COTP	Captain of the Port
CPI	Consumer Price Index
CWA	Clean Water Act
EEZ	Exclusive Economic Zone
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
IMO	International Maritime Organization
MISLE	Marine Information for Safety and Law Enforcement
NAICS	North American Industry Classification System
NANCPA	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990
NISA	National Invasive Species Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic aromatic hydrocarbon
PARI	Permit Authorization and Record of Inspection
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
RFA	Regulatory Flexibility Act
RO-RO	Roll-on/roll-off
SBA	Small Business Administration
SBREFA	Small Business Regulatory Enforcement and Fairness Act
SIC	Standard Industrial Classification
sVGP	Small Vessel General Permit
TBT	Tributyltin
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
VGP	Vessel General Permit
WTLUS	Waterborne Transportation Lines of the United States

Executive Summary

EPA is developing permitting requirements for discharges incidental to the normal operation of non-recreational, non-military vessels less than 79 feet into inland waters or the territorial sea of the United States under the National Pollutant Discharge Elimination System (NPDES). The proposed *Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels Less than 79 Feet* (herein referred to as the Small Vessel General Permit or sVGP) covers non-recreational and non-military vessels Less than 79 feet in length.[1]

To obtain authorization under the sVGP:

- Vessel operators must meet the sVGP eligibility requirements.
- Vessel operators must maintain a Permit Authorization and Record of Inspection (PARI) form onboard their vessel to certify that they have read and understood the terms of the permit and to document performance of the required annual inspection. Vessel operators are not required to submit a Notice of Intent (NOI) to obtain coverage under this permit.
- Vessel operators must implement the effluent limits according to the requirements in Part 2 of the sVGP, including by conducting routine inspections that may be needed to verify compliance with the discharge limits.
- Vessel operators must conduct the required annual self inspection.

In addition to general requirements, the sVGP defines effluent limits for seven discharge categories. EPA estimates that between 115,000 and 138,000 vessels are potentially affected by the sVGP requirements. This report presents EPA's economic and benefits analyses of the impact of the sVGP on all affected vessels. Though the issuance of this permit is not a Federal regulation, EPA is conducting these analyses due to the potential impacts of the permit requirements.

The establishments that own and operate vessels that will be subject to the sVGP are primarily associated with the fishing and water transportation industries, and with the oil and gas sector within the mining industry. *Section* 4*: Profile of the Fishing, Water Transportation, and Mining Industries* summarizes the characteristics of these industries.

To estimate the effect of sVGP requirements on an industry as a whole, EPA's analysis takes into account previous conditions and determines how the industry would act in the future in the absence of Permit requirements. The baseline for this analysis is full industry compliance with existing federal and state regulations and with current industry practices or standards that exceed current regulations to the extent that they can be empirically observed. *Section 5: Cost of Effluent Limits and Related Requirements* presents EPA's analysis of potential compliance costs to vessels associated with each of the practices and discharge categories identified in the sVGP, and with the inspection and recordkeeping requirements. Overall, EPA finds that sVGP requirements could result in total annual incremental costs for domestic vessels ranging between $7.0 million and $12.1 million

[1] If auxiliary vessels or craft, such as lifeboats or rescue boats less than 79 feet onboard larger vessels require permit coverage, they are eligible for coverage under this permit and are covered by submission of the Notice of Intent for larger vessels. Recreational vessels as defined in section 502(25) of the Clean Water Act are not subject to this permit.

(2010$), in the aggregate. This includes the paperwork burden costs and the sum of all practices for applicable discharge categories. Per vessel incremental compliance costs average between $17 and $98 per year, depending on the number of applicable discharge categories and baseline practices.

To evaluate economic impacts of revised sVGP requirements on the affected industries, EPA performed a firm-level analysis, described in *Section* 6*: Analysis of Impacts on Firm Revenues and Financial Performance*. The firm-level analysis examines the impact of any incremental cost per vessel to comply with the sVGP requirements on model firms that represent the financial conditions of "typical" businesses in each of the examined industry sectors. Since nearly all firms in the affected industries are small, the firm-level analysis focuses on assessment of impacts on small businesses. Further, given the distribution of revenue among firms in the affected industry sectors which suggests a relatively greater potential for impacts to small firms in the commercial fishing industry, EPA looked more specifically at this industry when assessing the significance of impacts. To evaluate the potential impact of the sVGP on small entities, EPA used a cost-to-revenue test to evaluate the potential severity of economic impact on vessels and facilities owned by small entities. The test calculates annualized pre-tax compliance cost as a percentage of total revenues and uses a threshold of 1 and 3 percent to identify facilities that would be significantly impacted as a result of this Permit. Based on this firm-level analysis, EPA concludes that that the sVGP is unlikely to have a significant economic impact on a substantial number of small entities given the preponderance of evidence showing that few firms have revenue below those where the compliance costs would exceed the one percent cost-to-revenue threshold under high end cost assumptions.

Although EPA was unable to evaluate the expected benefits of the Permit in dollar terms due to data limitations, the Agency collected and developed relevant information to enable qualitative consideration of ecological benefits and to assess the importance of the ecological gains from implementation of the sVGP. This information is included in *Section* 7*: Benefits*. EPA expects that the sVGP will benefit society in two broad categories: (1) enhanced water quality from reduced pollutant discharges and (2) reduced risk of invasive species introduction. Many of the discharges regulated by EPA's sVGP are associated with a wide variety of harmful pollutants in substantial concentrations (EPA, 2010b). Because many of the nation's busiest ports are considered to be impaired by a variety of pollutants found in vessel discharges, reducing pollutant loadings from these discharges is expected to have benefits associated with the reduction of concentrations of nutrients, metals, oil, grease, and toxics in waters with high levels of vessel traffic.

1 INTRODUCTION

1.1 BACKGROUND

On December 18, 2008, EPA finalized the first iteration of the Vessel General Permit (VGP) for discharges incidental to the normal operation of a vessel into inland waters or the 3 mile territorial sea of the United States under the National Pollutant Discharge Elimination System (NPDES) (73 CFR 117). The VGP covers incidental discharges from non-recreational[2], non-military vessels greater than 79 feet. As a result of P.L. 110-299 (as amended by P.L. 111-215)[3], non-recreational vessels less than 79 feet and most commercial fishing vessels regardless of size did not get NPDES permit coverage except for their ballast water discharges.

EPA is proposing the Small Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels Less Than 79 Feet (herein referred to as the Small Vessel General Permit or sVGP) for discharges incidental to the normal operation of non-recreational, non-military vessels less than 79 feet (including commercial fishing vessels). EPA is proposing the sVGP to provide permit coverage to these classes of vessels at the expiration of the P.L. 110-299 moratorium.

Non-recreational, non military vessels less than 79 feet are eligible for coverage under the sVGP. To obtain authorization under the sVGP:[4]

- Vessel operators must meet the sVGP eligibility requirements.
- The vessel receives permit coverage under the sVGP and is authorized to discharge in accordance with Permit conditions, provided they certify their Permit Authorization and Record of Inspection (PARI) form. Vessel operators must maintain the PARI form onboard their vessel to certify that they have read and understood the terms of the permit and to document performance of the required annual inspection.
- Vessel operators are not required to submit a Notice of Intent (NOI) to obtain coverage under this permit.

[2] Recreational vessels are not subject to the requirement to obtain an NPDES permit to authorize discharges incidental to their normal operation, in accordance with Senate bill S. 2766 ("the Clean Boating Act of 2008", P.L. No. 110-288). This law directs EPA to evaluate recreational vessel discharges, develop management practices for appropriate discharges, and promulgate performance standards for those management practices. It then directs the Coast Guard to promulgate regulations for the use of the management practices developed by EPA and requires recreational boater compliance with such practices. For more information about EPA's activities under the Clean Boating Act, please see: http://water.epa.gov/lawsregs/lawsguidance/cwa/vessel/CBA/about.cfm.

[3] On July 31, 2008, Senate bill S. 3298 was signed into law (P.L. No. 110-299). This law generally imposes a two-year moratorium during which time neither EPA nor states can require NPDES permits for discharges incidental to the normal operation of vessels of less than 79 feet and commercial fishing vessels of any length. It also directs EPA to conduct a study of vessel discharges and issue a report to Congress within 15 months. Among other things, the moratorium does not apply to ballast water. The law was subsequently amended by P.L. 111-209 to set the end of the moratorium to December 18, 2013.

[4] The descriptions of permitting requirements in this report are based upon the June 15, 2011 version of sVGP.

- Vessel operators implement the effluent limits according to the requirements in Part 2 of the sVGP, including by conducting routine inspections that may be needed to verify compliance with the discharge limits.
- Vessel operators must conduct the required annual self inspection.

Based on an analysis of vessel data sources (described in *Section* 2), EPA estimated that between 115,000 and 138,000 vessels are potentially affected by the sVGP requirements. In addition to general requirements, the sVGP defines effluent limits for seven discharge categories. This report presents EPA's economic and benefits analyses of the impact of the sVGP on all affected vessels. Though the issuance of this permit is not a Federal regulation, EPA is conducting these analyses due to the potential impacts of this permit.

1.2 ORGANIZATION OF THE REPORT

This report is organized in seven sections, including this introduction, as follows:

Section 2*: Population of Affected Vessels* presents an assessment of the numbers and types of vessels likely to be affected by the new permitting requirements.

Section 3*: Permit Overlap with Existing Regulations* summarizes laws and associated regulations that already cover certain discharges that would be subject to the new permitting regime.

Section 4*: Profile of the Fishing, Water Transportation, and Mining Industries* provides an economic profile of sectors that have vessels subject to the sVGP.

Section 5*: Cost of Effluent Limits and Related Requirements* presents EPA's analysis of compliance costs to commercial vessels associated with each of the BMPs identified by EPA in the Permit at the vessel level. This chapter also presents an estimation of national-level industry compliance costs.

Section 6*: Analysis of Impacts on Firm Revenues and Financial Performance* presents EPA's assessment of the cost and economic impact of regulatory requirements on firms in the shipping industry, and the implications of a Permit in terms of financial viability of shipping industry firms subject to the Permit.

Section 7*: Benefits* presents EPA's assessment of the environmental effects associated with vessel discharges and the benefits of reducing these discharges.

2 POPULATION OF AFFECTED VESSELS

The sVGP is applicable to discharges incidental to the normal operation of a vessel into the navigable waters within the meaning of the Clean Water Act (CWA) Section 502(7). All non-military, non-recreational vessels operating in a capacity of transportation, and that meet the specified maximum size limits (less than 79 feet) are eligible for coverage under the sVGP for their incidental discharges. Vessels of the armed forces of the United States are not eligible for coverage by this permit.

In estimating the number and characteristics of vessels potentially subject to the sVGP, EPA relied primarily on information presented in *Report to Congress: Study of Discharges Incidental to Normal Operation of Commercial Fishing Vessels and Other Non-Recreational Vessels Less than 79 Feet* (EPA, 2010), but adjusted the population estimates to subtract commercial fishing vessels 79 feet or larger. As characterized in that report, the vessel population potentially subject to the sVGP includes various types of commercial fishing vessels (purse seiner, troller, crabber/lobster, gillnetter, trawler, longliner, etc.), tugs and towing vessels, water taxis and small ferries, tour boats, and various other types of vessels used for non-recreational purposes (law enforcement, fire/rescue, research, etc.). Approximately 115,000 to 138,000 vessels are estimated to be potentially subject to the sVGP.

According to the Clean Boating Act of 2008 (CBA) (P.L. 110-288), vessels that are manufactured or used primarily for pleasure are "recreational vessels" subject to regulations under that Act. As discussed below, because the number of vessels that are manufactured for pleasure but used for commercial service is difficult to estimate, we generally included these vessels in the upper bound estimate of the number of vessels potentially subject to the sVGP.

2.1 DOMESTIC VESSEL POPULATION

The domestic vessel population estimates presented in EPA (2010b) were derived primarily from data gathered by the U.S. Coast Guard in the U.S. Coast Guard's Marine Information for Safety and Law Enforcement (MISLE) database (USCG, 2009). While the database's main purpose is to allow the tracking of safety and law enforcement incidents, MISLE provides a wide range of information regarding vessel and facility characteristics, accidents, marine pollution incidents, and other pertinent information tracked by the U.S. Coast Guard. Where possible, EPA complemented the data available in MISLE with information obtained from published sources or from consultations with U.S. Coast Guard personnel or port authorities.

MISLE includes data for a total of nearly one million vessels that operate in U.S. waters. The database covers a wide ensemble of vessels (e.g., recreational vessels, commercial fishing vessels, freight barges, tank barges, tank ships, passenger vessels, utility vessels), and provides data on various characteristics for each individual vessel. These data include:

- Identification number(s)
- Vessel category (e.g., class, type, subtype, service)
- Size (e.g., tonnage, length, breadth, depth)

- Area of operation (e.g., hailing port, route type)
- Passenger and crew capacity
- Propulsion (i.e., method, engine type, and horsepower)
- Construction material and design (e.g., hull material, design type, hull configuration/shape)
- Year built or age

EPA's analysis of the MISLE data suggests that approximately 115,000 to 138,000 vessels may meet the sVGP applicability criteria. *Table 2-1* summarizes the distribution of vessels potentially subject to the sVGP by size category and type.

Table 2-1: Estimate Population of Operational, Domestic Vessels Potentially Subject to sVGP, by Size.

Size	Commercial Fishing	Other Non-Recreational	Unspecified Vessel Type	TOTAL [b]
Less than 79 ft	54,176	32,799	15,011	
Zero or Null [a]	13,537	9,696	12,364	
Total (lower bound estimate) [c]	**67,178**	**32,806**	**15,012**	**114,996**
Total (upper bound estimate) [d]	**67,713**	**42,495**	**27,375**	**137,583**

Source: U.S. EPA, 2010, as determined from data compiled by the U. S. Coast Guard, MISLE database, 2009

[a] MISLE indicates a length of zero or the vessel length field is blank.

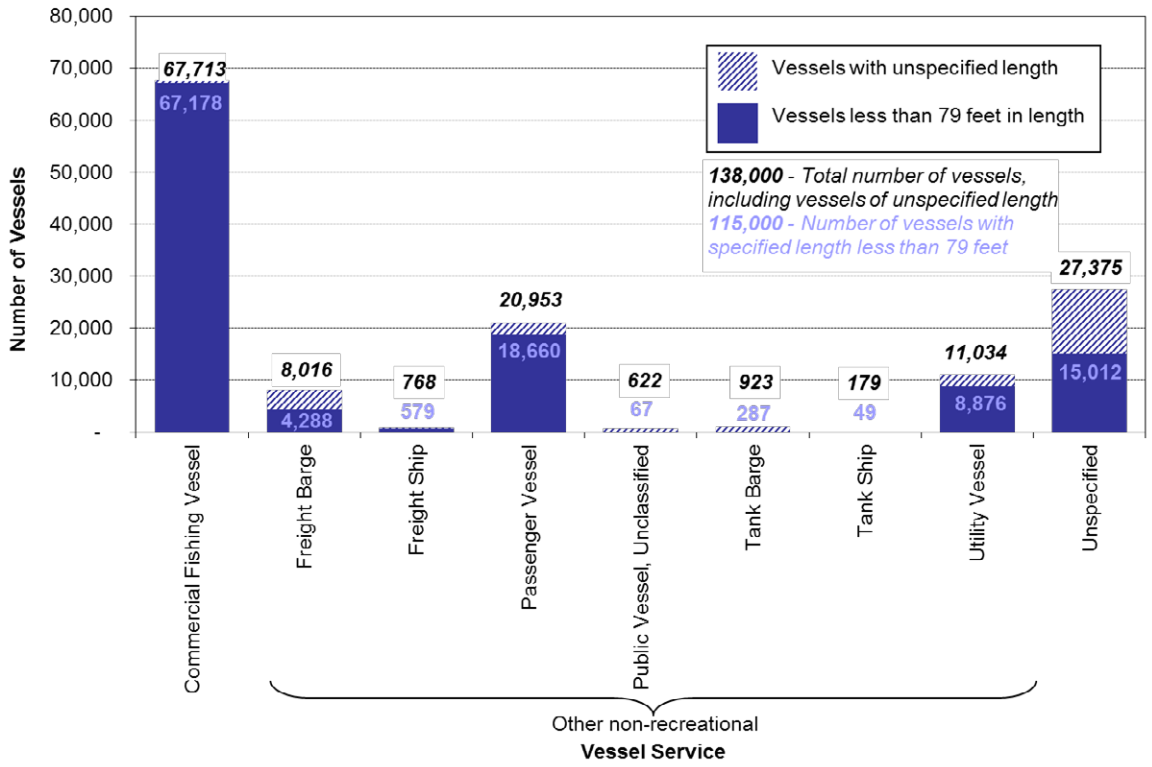
[b] Range indicates number of vessels when excluding (lower bound) vs. including (higher bound) vessels with zero or unknown length. Note that the estimates may include some vessels that are used in non-recreational service (e.g., commercial fishing or law enforcement) but that were manufactured as pleasure vessels.

[c] Includes a fraction of vessels with length reported as zero or null in the MISLE database, based on the share of vessels in the overall vessel population for each vessel type that are reported to be less than 79 feet (96% of commercial fishing vessels, 0.1% of other non-recreational vessels, and 0.0% of vessels of unspecified type).

[d] Assumes all vessels with length reported as zero or null in the MISLE database are less than 79 ft.

Figure 2-1 illustrates the estimated distribution of vessels within the potentially affected vessel population by vessel service (type). Approximately one-half of these vessels are commercial fishing vessels involved in such activities as fish catching (e.g., longliner, shrimper, and trawler), fish processing, fishing tenders, and charter fishing. The other half are distributed among a variety of vessel classes, including passenger vessels (e.g., water taxis, tour boats, harbor cruise ships, dive boats), utility vessels (e.g., tug/tow boats, research vessels, offshore supply boats), and freight barges.

Figure 2-1: Number of Vessels Potentially Subject by the sVGP, by Vessel Service (Type).



Note: The figure is based on operational, U.S.-flagged commercial fishing vessels (regardless of length) and other non-recreational vessels less than 79 feet in length.

Source: U.S. EPA, 2010, based on data from U. S. Coast Guard, MISLE database, 2009

2.1.1 COMMERCIAL FISHING VESSELS

As shown in *Figure 2-1*, as many as 68,000 commercial fishing vessels represent the largest category of domestic vessels potentially covered by the sVGP. According to the vessel service categories used by the U.S. Coast Guard in MISLE, "commercial fishing vessels" are vessels involved in such activities as fish catching (e.g., longliner, shrimper, and trawler), fish processing, and charter fishing.[5]

The U.S. Coast Guard generally describes commercial fishing vessels as including fishing vessels, fish tender vessels, and fish processing vessels as follows:

[5] Several charter fishing vessels are categorized as "commercial fishing vessels" in MISLE even though they are generally not considered commercial fishing vessels by the U.S. Coast Guard Fishing Vessel Safety Program. That program considers these vessels to be passenger vessels (Source: Personal communication with Jack Kemerer, Fishing Vessel Safety Program, May 26, 2009). According to the Coast Guard definition, the key difference between vessels formally classified as commercial fishing vessels and recreational vessels or passenger vessels that may be used in fishing activities is whether the catch is sold.

- Fish processing vessel[6] means a vessel that commercially prepares fish or fish products other than by gutting, decapitating, gilling, skinning, shucking, icing, freezing, or brine chilling.
- Fish tender vessel means a vessel that commercially supplies, stores, refrigerates, or transports fish, fish products, or materials directly related to fishing or the preparation of fish to and from a fishing, fish processing, or fish tender vessel or a fish processing facility.
- Fishing vessel means a vessel that commercially engages in the catching, taking, or harvesting of fish or an activity that can reasonably be expected to result in the catching, taking, or harvesting of fish.

While there is some overlap in service use for commercial fishing vessels and other vessel categories, such as passenger vessels (e.g., charter fishing), EPA assumed that the categorization used in MISLE generally follows the U.S. Coast Guard definition of commercial fishing vessels.[7]

According to MISLE data, approximately 13 percent of vessels classified as commercial fishing vessels are 50 to 79 feet in length (8,854 vessels), 58 percent (39,179 vessels) are between 26 and 50 feet, and the remaining 29 percent (19,679 vessels) are less than 26 feet.[8] While MISLE does not provide sufficient information to break out the population of vessels according to their original design (e.g., built as pleasure craft), EPA expects that a significant share of vessels less than 26 feet may consist of vessels originally manufactured as pleasure craft and therefore defined as "recreational" vessels in the Clean Boating Act.[9] These vessels would not be covered under this permit. Later sections of this report discuss the implications of this understanding on the estimated costs of the sVGP.

2.1.2 OTHER NON-RECREATIONAL VESSELS

Excluding the approximately 27,000 "unspecified" vessels shown in *Figure 2-1*, "passenger vessels" have the second highest number of domestic vessels potentially covered by the sVGP, with up to 21,000 vessels, when counting all vessels potentially less than 79 feet in length. These vessels are further divided into subtypes according to the types of activities in which they are involved (e.g., diving vessels, charter fishing vessels, ferry, harbor cruise vessels, sailing vessels).

[6] The moratorium provided by P.L. 110-299 applies only to discharges incidental to the normal operation of a vessel when acting in the mode of transportation. EPA requires NPDES permits for seafood processing vessel discharges when they are created by the processing of seafood as an industrial activity.

[7] The MISLE classification also depends on the information provided directly by the vessel owner or operator on the application for documentation or renewal (*Source:* Personal communication with Jack Kemerer, Fishing Vessel Safety Program, May 26, 2009).

[8] This distribution by size assumes that vessels with length recorded as zero are to be included among the vessels less than 26 feet.

[9] The Clean Boating Act of 2008 defines recreational vessels as follows: (A) IN GENERAL.—The term 'recreational vessel' means any vessel that is—(i) manufactured or used primarily for pleasure; Or (ii) leased, rented, or chartered to a person for the pleasure of that person. (B) EXCLUSION.—The term 'recreational vessel' does not include a vessel that is subject to Coast Guard inspection and that— (i) is engaged in commercial use; or (ii) carries paying passengers.

The service category labeled "public vessel, unclassified" accounts for about 600 vessels (e.g., lighthouse tender vessels, hospital ships, law enforcement vessels, ice breakers). The "utility vessels" category covers remaining types of vessels, including tug/tow boats, school ships, research vessels/ships, mobile offshore drilling units, offshore vessels, offshore supply vessels, oil recovery vessels, and industrial vessels. More than 11,000 vessels are classified as utility vessels in MISLE.[10] Freight barges (8,016 vessels), freight ships (768 vessels), tank barges (622 vessels), and tank ships (179 vessels) account for the remaining non-recreational vessels potentially covered by the sVGP.

According to MISLE data, approximately 19 percent of other non-recreational vessels are in the 50 to 79 feet range (13,111 vessels), 38 percent (26,210 vessels) are between 26 and 50 feet, and the remaining 44 percent (30,547 vessels) are less than 26 feet. The proportions of vessels in each of the three size categories vary by vessel type, however, with almost two thirds of passenger vessels in the 26 to 50 feet range, as compared to 91 percent of public vessels less than 26 feet. Similar to commercial fishing vessels, EPA expects that a significant share of vessels less than 26 feet may consist of vessels originally manufactured as pleasure craft and therefore defined as "recreational" vessels in the CBA. These vessels would not be covered under this permit. Later sections of this report discuss the implications of this understanding on the estimated costs of the sVGP.

2.2 FOREIGN VESSEL POPULATION

The Foreign Traffic Vessel Entrances and Clearances database provides information on foreign vessels entering or clearing U.S. Customs ports in calendar year 2008, the most recent year for which data are published (U.S. Army Corps of Engineers, 2010). The data are compiled by the U.S. Army Corps of Engineers from information originally collected by U.S. Customs and Border Protection. They include entrance/clearance statistics such as the date a vessel made entry into or cleared the U.S. Customs port or waterway, as well as vessel characteristics such as the name, type by rig or ICST code, flag of registry, last (for entrances) or next (for clearances) port of call, whether foreign or domestic, Net and Gross Registered Tonnage, and draft in feet. The database includes both foreign flagged and domestic vessels. However, only foreign flagged vessels are included in estimates of the foreign vessel population presented here.

To estimate the number of foreign vessels that could be potentially subject to the sVGP requirements, EPA imputed a vessel length for each reported vessels by using a relationship between gross registered tonnage and vessel length previously derived from MISLE data (U.S. EPA, 2010) which indicated that 79 feet is roughly equivalent to 150 gross registered tons.

A review of the clearance data show that 112 unique foreign vessels less than 150 gross registered tons received clearance in 2008. This relatively small number of foreign vessels may be in part attributable to the Jones Act[11] which requires that all goods transported by water between U.S.

[10] Some vessel service categories did not fall into one of the listed categories. EPA determined an appropriate service category based on information provided in other vessel classification fields (class, type, subtype).

[11] Section 27 of the Merchant Marine Act of 1920 (P.L. 66-261).

ports be carried by U.S. flagged ships. Most vessels in the relevant size category are likely to be engaged in trade within U.S. waters.

EPA used ICST codes to group foreign flagged vessels into the classes used in the analysis of the domestic vessel population. *Table 2-2* presents the number of foreign flagged vessels by vessel type. As shown in *Table 2-2,* the majority of foreign flagged vessels entering U.S. ports are utility vessels (52 percent), followed by commercial fishing vessels (40 percent). Almost 60 percent of the vessels are from Canada, with the Bahamas (7%), Mexico (5%), and Panama (4%) the only other countries with more than three vessels each.

Note that foreign flagged vessels are excluded from the analysis of the total costs of best management practices (BMPs) described later in this report because the compliance cost for foreign flagged vessels is not expected to have a direct impact on U.S. firms. There is also considerable uncertainty regarding management practices employed by these vessels under the baseline scenario.

Table 2-2: Foreign Vessel Population.

Vessel Type	Total Foreign Vessels [a]	
	Count	Percentage of Total
Utility Vessel	58	52
Commercial Fishing Vessel	45	40
Freight Ship	3	3
Tank Ship	3	3
Freight Barge	2	2
Other	1	1
Total	**112**	**100**

[a] Includes only vessels less than 150 gross registered tons in weight.

2.3 UNCERTAINTIES AND LIMITATIONS

This section discusses limitations and uncertainties in the estimation of the affected vessel population. Whether these limitations and uncertainties, taken together, are likely to lead to an understatement or overstatement of the estimated vessel population is not known.

The domestic vessel population was estimated using the MISLE database. The main limitations of this data source include:[12]

- *Incomplete data*. While MISLE represents the most comprehensive national dataset currently available, it does not capture the entire universe of vessels operated on U.S. waters. Only limited information is available for certain classes of vessels, such as smaller vessels, due to the way in which vessel data are gathered since these vessels are not subject to documentation or regular inspection requirements. In compiling MISLE data, the U.S. Coast Guard largely relies on documents submitted by vessel owners or

[12] See EPA (2010) for a more detailed discussion of the limitations of MISLE data.

operators in accordance with vessel documentation requirements (e.g., certificate of documentation) or on information gathered by U.S. Coast Guard staff directly (e.g., during inspections, vessel boardings, or accident investigations). Thus, the database incorporates data also reported separately in VESDOC for documented vessels.[13] The scope of the MISLE database is not limited to a certain size or class of vessel, but the content of the database is nonetheless driven in part by the regulatory requirements to which different types of vessels are subject or by activities conducted by Coast Guard offices. MISLE therefore, is generally considered to be most comprehensive for those vessels that are documented, state registered, and/or subject to inspection requirements. Most recreational vessels are not subject to documentation or regular inspection requirements and thus are not captured in MISLE.14 Data omissions are believed to affect primarily recreational vessels. Since recreational vessels are not covered by the proposed sVGP and are therefore not the primary focus of this report, EPA believes that data limitations do not preclude the use of the MISLE data for the current analysis to generally describe the characteristics of study vessels.

- *Missing data fields.* While MISLE captures a wide range of characteristics for each vessel it records, the information is at times incomplete (e.g., length may be missing or recorded as zero) or may be outdated (e.g., a vessel may no longer be operating while its status in the database may not have been updated). EPA conservatively included in the potentially affected vessel population all vessels for which the length was unknown and all vessels that met the sVGP applicability criteria.
- *Recreational vessels.* The Clean Boating Act defines as recreational vessels any vessel that is "—(i) *manufactured or used primarily for pleasure*; or (ii) leased, rented, or chartered to a person for the pleasure of that person." According to this definition, vessels that have been manufactured as pleasure crafts may be considered recreational vessels (subject to exclusions in the CBA). The vessels data contained in MISLE, however, do not distinguish vessels according to their design or manufacture. EPA conservatively included all vessels used in relevant types of service (commercial vessels, freight vessels, utility vessels, etc.), but expects that some of these vessels may have been manufactured as recreational vessels and therefore may not be covered by the sVGP. The population of vessels subject to sVGP requirements could therefore be smaller than assumed in most of the analysis presented in this report. Further, EPA expects that smaller vessels (e.g., less than 26 feet) are more likely to have been originally intended as recreational vessels but repurposed to other service.

The estimated number of foreign vessels affected by the sVGP was estimated using vessel entrances and clearances data for 2008. The data source does not include vessel length. EPA

[13] VESDOC is a data file of merchant and recreational vessels documented under the laws of the United States by the U.S. Coast Guard. That dataset was used for the economic analysis of the 2008 VGP (Abt Associates, 2008).

[14] While the number of recreational vessels recorded in MISLE is high (over 700,000), the database accounts for only a small fraction of the 16.9 million recreational vessels estimated to operate in U.S. waters, according to EPA's Economic Impact Analysis of the Recreational Vessel Permit (USEPA, 2008a) and to the National Marine Manufacturers Association's (NMMA's) 2007 U.S. Recreational Boat Registration Statistics (NMMA, 2009).

imputed the vessel length based on a relationship previously derived between tonnage (as gross registered ton) and length (in feet) for different classes of vessels. It is possible that some vessels are larger or smaller than estimated using the relationship.

Finally, the estimate of the population of affected vessels is also subject to the reporting accuracy of the data providers. Typographical errors and incorrect entries (including potential duplicate entries) exist to an unknown extent. Those that were discovered were corrected.

3 PERMIT OVERLAP WITH EXISTING REGULATIONS

Several categories of best management practices outlined in the Vessel General Permit overlap with existing regulations and statutes at the federal and state level. In accordance with these regulations, some vessels have adopted BMPs required under the Small Vessel General Permit. This chapter cross-references existing regulations affecting vessel discharges and BMP requirements under the Small Vessel General Permit. EPA used the analysis of the overlap to adjust the number of vessels that are likely to incur incremental costs as a result of sVGP implementation.

3.1 OVERLAP WITH CLEAN WATER ACT PROVISIONS

Section 311 of the Clean Water Act states that it is U.S. policy that there should be no discharges of oil or hazardous substances[15] into waters of the U.S., adjoining shorelines, into or upon the waters of the contiguous zone, and in certain other specified instances, except where permitted under MARPOL/APPS or where in quantities the president has, by regulation, determined not to be harmful (33 U.S.C. §§ 1321(b)(1)-(b)(3)).

The term discharge excludes discharges in compliance with a National Pollutant Discharge Elimination System (NPDES) permit under CWA § 402. However, certain discharges are exempt from the NPDES requirements under the Clean Water Act. Discharges occurring more than 3 nm from shore and discharges by Armed Forces vessels are exempt from the previous 122.3(a) exclusion, and are therefore excluded from the requirements of this permit. Sewage/blackwater is covered by performance standards for sanitation equipment, and is excluded from the definition of pollutant contained in Section 502(6)(A) of the CWA and thus is not subject to NPDES permitting. These discharges, as well as discharges from vessels not operating as a means of transportation or discharges by recreational vessels covered by the Clean Boating Act of 2008, are outside the scope of this analysis.[16]

EPA's Regulations of the Discharge of Oil at 40 CFR part 110 defines discharges of oil in quantities as may be harmful, pursuant to the CWA. Notably, the regulation prohibits discharges of oil that "(a) Violate applicable water quality standards; or (b) Cause a film or sheen upon or dis-coloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines." The prohibition applies to oil as broadly defined in the CWA to include "oil of any kind or in any form, including petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil." Additionally, the regulation prohibits the addition of dispersants or emulsifiers to oil to mitigate

[15] A list of hazardous substances EPA has designated under the CWA can be found at 40 CFR § 116.1. It includes both ethylene glycol and methanol.

[16] An unknown number of vessels included in the populations of commercial fishing and other non-recreational vessels may have been originally manufactured as pleasure crafts and would therefore be "recreational" vessels as defined by the Clean Boating Act of 2008. Implications of excluding these vessels are discussed later in this report.

the appearance of a sheen. Finally, the regulation requires notification to the National Response Center as soon as a vessel owner has knowledge of any discharge of oil.

EPA's 1996 revisions to its Regulations of the Discharge of Oil, implemented under the authority of the CWA, specifically addressed the discharge of bilge slops containing sufficient oil to create a film or sheen in the territorial waters of the United States. This requirement regarding oil levels in bilge water for non-MARPOL vessels remains the same in the new Permit.

Given the existing statutory and regulatory requirements applicable to discharges of oil, owners and operators are expected to already make every effort to prevent and mitigate discharges of oil from their vessels. To the extent that practices called for in the sVGP to control such discharges are already being implemented, there will be no incremental cost to vessel owners for implementing these practices in compliance with the sVGP. Assumptions regarding baseline implementation are discussed in *Section* 5 of the report.

3.2 GRAYWATER

Graywater is defined in the Small Vessel General Permit as the discharge derived from "galley, bath, and shower water, as well as wastewater from lavatory sinks, laundry, and water fountains." Several states have requirements that apply specifically to graywater discharges from cruise ships.[17] These regulations, however, do not generally apply to the smaller passenger vessels addressed by the sVGP.

Two federal regulations are relevant to graywater discharges. First, under Section 312(a) of the CWA, graywater discharges from commercial vessels in the Great Lakes region as defined in §312(a)(10) are currently treated as sewage and thus are excluded from the scope of the new Permit. Second, the National Marine Sanctuaries Act authorizes the National Oceanic and Atmospheric Administration (NOAA) to designate National Marine Sanctuaries. There are currently thirteen national marine sanctuaries and one marine national monument. Additional restrictions and requirements may be imposed on vessel owners/operators who operate in and around these areas to protect sensitive ecosystems, including notably the discharge of graywater. For example, regulations governing the Gulf of the Farallones National Marine Sanctuary prohibit the discharge "from within or into the Sanctuary, other than from a cruise ship, any water or other organic matter except… clean vessel deck wash down, clean vessel engine cooling water, clean vessel generator cooling water, clean bilge water, or anchor wash." (15 CFR § 922.82(a)(2)(iii)). EPA assumes that Permit requirements that reiterate practices already implemented to comply with existing regulations of graywater discharges do not impose incremental costs on vessel owners.

[17] States with regulations specific to graywater discharges from cruise ships include, for example, Alaska, California, Hawaii, Maine, and Washington.

3.3 ANTI-FOULING HULL COATINGS

The new Small Vessel General Permit under NPDES prohibits the use of organotin-based anti-fouling hull coatings. The Organotin Anti-fouling Paint Control Act of 1988, U.S.C. §§ 2401-2410, already prohibits the use of these compounds on vessels under 25 meters or less in length, unless the vessel hull is aluminum or the paint is applied to an outboard motor; therefore, these vessels will not incur any additional costs under this provision. In September 2008, the U.S. Senate gave its advice and consent to ratification of the International Convention on the Control of Harmful Anti-fouling Systems on Ships, which bans the use of all organotin compounds and enacted implementing legislation in January 2010.

EPA has already cancelled all U.S. FIFRA registration for TBT antifouling paints (the last cancellation became effective December 31, 2005). Any current use of these products is dwindling because there are very limited or no stock of the products remaining on the market.

As a result, the organotin provisions of the sVGP are assumed to impose no incremental cost on vessel owners.

3.4 TRANSPORT OF AQUATIC NUISANCE SPECIES

The National Invasive Species Act of 1996 (NISA), which reauthorized and amended the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990, aims to prevent, monitor and control the unintentional introduction and dispersal of nonindigenous species into waters of the U.S. through ballast water and other pathways. In addition to ballast water guidelines, NISA requires the development of guidelines to prevent the spread of nonindigenous species from other vessel operations such as hull fouling. Among the guidelines contained in NISA are regular hull cleaning either in-water or during drydock. For example, the implementing Coast Guard regulations require that all vessels equipped with ballast water tanks that operate in waters of the U.S. have fouling organisms removed from their hulls, piping, and tanks on a regular basis, and that any removed substances be disposed of in accordance with local, state, and other federal regulations (33 CFR §151.2035(a)(6)). NISA focuses on vessels with ballast water tanks that travel outside the exclusive economic zone (EEZ) or along the coasts inside the EEZ. The sVGP requirements to minimize the discharge of ballast water and to visually inspect and as necessary clean the vessel hull of attached organisms are expected to complement NISA for small non-recreational vessels. These practices have the potential to impose an incremental cost on owners of vessels subject to the sVGP as discussed later in *Section 5.2.6*.

4 PROFILE OF THE FISHING, WATER TRANSPORTATION, AND MINING INDUSTRIES

4.1 INTRODUCTION

The establishments that own and operate a large share of the vessels that will be subject to the sVGP are primarily associated with the fishing and water transportation industries, and with the oil and gas sector within the mining industry.

According to the most recent Census figures, the water transportation industry is a $48 billion industry that employs over 157,000 people on a payroll of over $8 billion. The fishing industry is much smaller, with total revenues of $1.66 billion, employing 5,600 people on a payroll of $302 million. The drilling oil and gas wells sector (a subset of the mining industry) is a $22.5 billion sector that employs nearly 106,900 people on a payroll of almost $6 billion.

Water transportation accounts for a majority of the vessels sailing on U.S. waters, and the second largest share of vessels potentially covered by the sVGP. The industry is made up of several sectors, described in *Section 4.3.2*. Overall, the industry has experienced growth in the revenues, payroll and number of employees, but a decline in the number of establishments. It is important to note that the most recent revenue, employment and establishment data are for 2007. The global economic crisis and U.S. recession likely impacted the water transportation as a reduced overall flow of goods reduced shipping volume and other leisure water transportation activities decreased, it also likely also affected the fishing and mining industries.

The drilling oil and gas wells sector, which covers some of the utility vessels covered by the sVGP, has experienced strong growth, showing robust gains in revenue, employment and payroll from 2002 to 2007.

4.1.1 DATA SOURCES USED

Data for the number of vessels and their respective industry sector were extracted from the MISLE database and from information EPA had previously obtained as part of its analysis of the VGP (U.S. EPA, 2008) (detailed further in *Section 2.1: Domestic Vessel Population*). NAICS codes were assigned to vessels according to the NAICS codes of their owner/operators, as obtained from the Dun & Bradstreet (2006), ReferenceUSA (2006), or Manta.com business databases. In selected instances, EPA assigned the most likely NAICS code based on key words in the reported name of the vessel owner where it could do so with reasonable confidence.[18] In cases where owner/operator information was unavailable, no corresponding company was found in the business databases, or the name of the owner was not descriptive enough to assign a NAICS sector, the most likely NAICS code was assigned to a vessel using information on vessel

[18] For example, companies whose name contained the term "dredging" had their vessels assigned to NAICS *2349: Other Heavy Construction*; the terms "charter", "tour", or "adventure" were associated with establishments operating in the sector NAICS *487210: Scenic and Sightseeing Transportation, Water*.

type and area of operation. Finally, in instances where it was not possible to determine the NAICS code based on vessel type or location, the vessel was not matched.

Overviews of the various industry sectors were created using information from industry groups, trade associations, and other reference sources. Data for numbers of firms, establishments[19], revenues, and employment were obtained from the U.S. Census Bureau, with the exception of data for North American Industry Classification System (NAICS) code 11411-Fishing, because it is not covered by the Economic Census. In this case, the data come from the U.S. Small Business Administration (SBA).

4.1.2 ORGANIZATION OF THIS CHAPTER

This chapter presents an overview of the fishing, water transportation, and mining industries.

Section 4.2 identifies the sectors associated with the vessels addressed by the sVGP, as classified by NAICS industry groups.

Section 4.3 provides definitions and overviews of the industry groups and their respective sectors.

Section 4.4 summarizes recent trends in each industry, including changes in the number of establishments and financial performance.

Section 4.5 describes the industries' market structures, including details of performance according to employment size, numbers and percentages of small businesses, employment trends, and payroll trends.

4.2 NUMBER OF VESSELS BY INDUSTRY SECTOR

Table 4-1 summarizes the number of vessels by NAICS code and industry sector, based on the industry sector associated with each vessel's reported managing owner.

There are approximately 115,000 to 138,000 commercial fishing vessels and other non-recreational vessels less than 79 feet long. Of these vessels, as many as 68,000, or about half, are involved in the commercial fishing industry. The sector with the next largest number of vessels is inland water transportation with 7,317 vessels and scenic and sightseeing transportation with 1,437 vessels. Establishments in the mining sector (specifically oil and gas drilling and support activities) are associated with 592 vessels. Deep sea, coastal and Great Lakes water transportation has relatively fewer vessels within the sVGP vessel population with 133, which is not altogether surprising given that one would expect few commercial deep sea vessels will be less than 79 feet. Overall, the water transportation industry has 9,493 vessels of the vessels for which NAICS codes could be determined.

[19] According to Census, an establishment is a single physical location at which business is conducted and/or services are provided. It is not necessarily identical with a company or enterprise, which may consist of one establishment or more. An establishment may be the local office of a shipping company and may operate several vessels, or it may be a single vessel operated as a single physical location. In the analysis, we generally relied on Census data on the number of firms and separate vessel databases as sources of our estimates of the number of firms and vessels, respectively.

The number of operators generally follow similar trends with the largest number of operators in the fishing industry, followed by water transportation, and mining. The average number of vessels operated by each managing owner seems to vary across the industry sectors from 1.3 for Scenic and Sightseeing Transportation, Water, to about 7 for owners in the mining sector. On average, managing owners of commercial fishing vessels operate about 3 vessels each, although a closer look at the data reveals that the distribution is skewed by one large company that operates 96 fishing vessels. Only 7 percent of operators in the fishing have more than one vessel.[20] These statistics are based on the number of vessels corresponding to uniquely named owners or operators and are therefore potentially subject to uncertainty due to potential differences in spelling of owner names for the same entity or possible relationships among seemingly distinct owners (e.g., subsidiaries of a same corporate entity).

Table 4-1: Number of Vessels and Operators by Industry Sector.

Industry Sector	Number of Vessels [a]	Number of Operators [b]
Water Transportation Industry and Related Sectors		
Deep Sea, Coastal, and Great Lakes Water Transportation	133	72
Inland Water Transportation	7,317	2,208 to 5,096[d]
Scenic and Sightseeing Transportation, Water	1,437	1,144
Support Activities for Water Transportation	606	163
Water Transportation Industry Total	*9,493*	*3,587 to 6,475*[d]
Fishing Industry		
Fishing	67,713	23,702 to 65,401[d]
Mining Industry		
Support activities for mining	592	90 to 400[d]
Other mining	15	2
Other Industries		
Other Industries	1,894	715
Unspecified [c]		
Vessels without NAICS code information	57,891	11,338

[a] Count represents an upper range estimate as it includes all vessels that have a length of zero or null in MISLE.

[b] Reflects the number of "unique" operators (defined by unique name) associated with vessels in each industry sector.

[c] Almost half the vessels did not have owner information and were not easily categorized into a NAICS by vessel type or location. These vessels are included in the "unspecified" category.

[d] A large number of vessels have no recorded managing owner. The upper bound of the range assumes that each of these vessels is owned by a different entity, while the lower bound represents the number of uniquely named entities.

Source: U.S. Coast Guard, MISLE 2009; Dunn&Bradstreet, 2006; ReferenceUSA, 2006.

Nearly 1,900 vessels are categorized in various, diverse industries not included in this industry profile. In general these vessels belong to a few broad sectors: construction, remediation and governmental services. Nearly 600 vessels are used in the construction industry, including in "other heavy construction," and "other specialty trade construction." A review of these vessels

[20] These statistics are based on the vessels that have named managing operators in the MISLE database. This field is blank for 41,669 of the commercial fishing vessels in the database.

suggests that many are used in dredging operations or to tow barges carrying aggregates or other construction material. Over 300 vessels are categorized as NAICS 5629: Remediation and other waste management. As most of the companies classified in this sector are oil spill response contractors or cooperatives, these vessels are likely involved with cleaning up oil spills. Over 400 vessels are involved with government services (NAICS code 92), primarily in transportation programs and utilities, but also police protection and environmental quality programs. There are also a vessels working in miscellaneous sectors, including about 200 vessels in the "other amusement and recreation services" and slightly fewer in scientific research.

Unfortunately, EPA was unable to classify 57,891 vessels or just under half of the vessels potentially subject to sVGP requirements, according to MISLE data. These vessels did not have owner/operator information that mapped to D&B or other business databases, had a non-descriptive owner name, and could not readily be assigned to a specific industry sector based on the vessel type or location. Because we assigned commercial fishing vessels to the fishing industry, the vessels with unknown industry sector are assumed to be in the water transportation or other industries and where distributed among the NAICS code in proportion to shares of vessels with known sectors.

4.3 OVERVIEW OF THE FISHING, WATER TRANSPORTATION, AND MINING INDUSTRIES

4.3.1 DEFINITION OF THE FISHING, WATER TRANSPORTATION, AND MINING INDUSTRIES

The fishing industry includes NAICS code 11411-Fishing. The water transportation industry, for the purpose of this chapter, includes NAICS codes 483: Water Transportation; 4872: Scenic and Sightseeing Transportation, Water; and 4883: Support Activities for Water Transportation. The support activities for mining industry includes two industry sectors that are most relevant to vessels covered by the sVGP: NAICS 213111: Drilling oil and gas wells and NAICS 213112: Support activities for oil and gas.

Table 4-2 lists the relevant NAICS codes for the fishing, water transportation, support activities for mining, and other industries associated with vessels potentially covered by the sVGP. These industry sectors are described in the remainder of this section in order of the relative number of vessels estimated to be potentially covered by the sVGP.

Table 4-2. Principal 2007 NAICS Codes and Descriptions Relevant to the sVGP.

Industry Group/NAICS Code	Description
Fishing	
1141	Fishing
114111	*Finfish Fishing*
114112	*Shellfish Fishing*
114119	*Other Marine Fishing*
Water Transportation	
4831	Deep Sea, Coastal, and Great Lakes Water Transportation
483111	*Deep Sea Freight Transportation*
483112	*Deep Sea Passenger Transportation*
483113	*Coastal and Great Lakes Freight Transportation*
483114	*Coastal and Great Lakes Passenger Transportation*
4832	Inland Water Transportation
483211	*Inland Waterways Freight Transportation*
483212	*Inland Waterways Passenger Transportation*
4872	Scenic and Sightseeing Transportation, Water
4883	Support Activities for Water Transportation
488310	*Port and Harbor Operations*
488320	*Marine Cargo Handling*
488330	*Navigational Services to Shipping and Salvage*
488390	*Other Support Activities for Water Transportation*
Support Activities for Mining	
2131	Support Activities for Mining
213111	*Drilling Oil and Gas Wells sector*
213112	*Support Activities for Oil and Gas Operations*
Other Industries	
2379	Other Heavy and Civil Engineering Construction
5417	Scientific Research and Development Services
5629	Remediation and Other Waste Management Services
7139	Other Amusement and Recreation Industries
9261	Administration of Economic Program

Source: U.S. Census Bureau, 2007

4.3.2 FISHING[21]

The fishing industry includes commercial catching or taking of finfish, shellfish, or miscellaneous marine products from a natural habitat, such as the catching of bluefish, eels, salmon, tuna, clams, crabs, lobsters, mussels, oysters, shrimp, frogs, sea urchins, and turtles (U.S. Census Bureau, 2007).

Since the 1990s, finfish volume has been declining, due to severely depleted fisheries in the Atlantic and loss of breeding grounds to pollution, as well as to increasingly strict regulations aimed at preventing these problems (Reference for Business, 2007a, b). Demand has not been

[21] Vessels subject to the ballast water requirements of the Permit include an estimated 26 commercial fishing vessels.

strong enough to prevent declines in the value of the catches. Shellfish volume has remained relatively constant, with the total value of the catch increasing slightly. Fish and seafood imports have increased over the same period, intensifying the competition in this industry (National Marine Fisheries Service, 2003).

In 2009, Alaska led the nation in both volume and value of fish caught. Louisiana and Virginia were second and third respectively in volume of fish caught, while Massachusetts and Maine were second and third in terms of value of fish landings (National Marine Fisheries Service, 2011).

According to MISLE data, an estimated 96 percent of the commercial fishing vessels operating domestically are less than 79 feet in length.

4.3.3 WATER TRANSPORTATION

Establishments in the water transportation industry provide water transportation of passengers and cargo using watercraft, such as ships, barges, and boats. The industry is composed of two industry groups, depending on the area they operate in: (1) deep sea, coastal, and Great Lakes water transportation; and (2) inland water transportation. This split typically reflects the difference in equipment used (U.S. Census Bureau, 2007).

Scenic and sightseeing water transportation services (NAICS 4872) are also included under this industry heading, as are support activities for water transportation (NAICS 4883). These two industry groups are technically classified outside of the "Water Transportation" industry grouping by the Census Bureau, but will be included under water transportation for the purposes of this chapter.

Total waterborne commerce in the United States has increased steadily over the past 50 years, fueled mostly by growth in foreign commerce, which overtook domestic shipments (in terms of weight) in the mid-1990s. Foreign commerce accounted for over 60 percent of total waterborne commerce by weight in 2009, amounting to 1.3 billion short tons out of total U.S. waterborne commerce of 2.1 billion short tons (USACE, 2009).

The types of vessels associated with the water transportation sector (e.g., freight barges, freight ships, passenger vessel, tank barges, and tank ships) have varying shares of vessels less than 79 feet, as shown in *Table 4-3*. While vessels less than 79 feet represent a relatively small share of vessels used to transport cargo (4 to 39 percent), over 90 percent of vessels used to transport passenger are less than 79 feet and therefore potentially covered by the sVGP.

Table 4-3: Fraction Vessels Less than 79 Feet, by Vessel Type.

Vessel Type	Percent of Vessels Less Than 79 feet [a]
Commercial Fishing Vessels	96%
Freight Barge	10%
Freight Ship	39%
Tank Barge	4%
Tank Ship	12%
Passenger Vessel	91%
Utility Vessels	63%

[a] Fraction of total number of vessels in MISLE that are less than 79 feet.

Source: U.S. Coast Guard, MISLE 2009.

DEEP SEA, COASTAL, AND GREAT LAKES WATER TRANSPORTATION (NAICS 4831)

This industry group comprises establishments primarily engaged in providing deep sea, coastal, and Great Lakes water transportation, as well as transportation via the St. Lawrence Seaway. Marine transportation establishments using the facilities of the St. Lawrence Seaway Authority Commission are considered to be using the Great Lakes Water Transportation System (U.S. Census Bureau, 2002). Firms in this NAICS grouping are further classified based on their area of operation (deep sea or coastal/Great Lakes) and payload type (cargo or passengers). As described below for the freight (NAICS 483113) and passenger transportation sectors (NAICS 483114).

While this industry group also includes deep sea freight and passenger transportation (NAICS 483111 and 483112, respectively), EPA expects that few vessels covered by the sVGP are engaged in these types of activities given their relatively small size.

Coastal and Great Lakes Freight Transportation: NAICS 483113

Firms transporting cargo in coastal waters; the Great Lakes System (including the St. Lawrence Seaway); or deep seas between ports of the United States, Puerto Rico, and U.S. island possessions or protectorates fall into this NAICS code classification (U.S. Census Bureau, 2007).

The Jones Act of 1920 requires that all domestic waterborne trade (between two points in the United States) be conducted on vessels built in the United States, documented in the United States, and owned by U.S. citizens or companies (Transportation Institute, undated). Thus, vessels operating in the Coastal and Great Lakes Freight Transportation sector are subject to this law.

The majority of the vessels in this sector are barges, though the sector is also characterized by its use of other freight transport vessels, as well as tugboats (Transportation Institute, undated). In the Great Lakes, the transportation system comprises bulk cargo carriers, ocean going vessels and smaller cruise ships. Predominant players are the bulk lake carriers, including, in 2002, 65 large self-propelled vessels and another 20 smaller tug/barge units (Quinn, 2002).

Coastal domestic trade to and from Alaska, Hawaii, and U.S. Territories consists mainly of the shipment of petroleum and petroleum products, chemicals, and agricultural products. The primary products transported on the Great Lakes System are coal, limestone, and iron ore (Transportation Institute, undated; Quinn, 2002). As described above, however, a relatively small share of the vessels involved in these activities is expected to be less than 79 feet.

Coastal and Great Lakes freight transportation accounts for nearly 30 percent of all U.S. domestic waterborne shipments by weight in 2009. Coastal and Great Lakes freight transport accounts for almost 90 percent of all self-propelled traffic, but only 13% of barge traffic by weight (USACE, 2009). Great Lakes freight transportation was relatively constant from 1990 to 2005, hovering around 150 million tons per year; however since 2006, there has been a significant dip in tonnage with only about 100 million tons shipped in 2009 (USACE, 2009). Generally, approximately two-thirds of Great Lakes tonnage is domestic cargo and one-third is foreign (this pattern remained even after the drop in tonnage) (USACE, 2009).

Coastal freight transportation experienced the same post-2005 dip with 1.4 billion tons shipped in 2009 down from 1.6 billion shipped in 2009. Coastal freight did experience the same growth from 1990 to 2005 increasing from around 1.1 billion tons per year to more than 1.6 billion tons, as a result of increased foreign shipments (USACE, 2009). It is likely that the dip in freight travel beginning in 2006 is due to the global economic crisis which decreased the overall flow of goods and thus decreased shipping volume.

Coastal and Great Lakes Passenger Transportation: NAICS 483114

This industry sector contains establishments primarily engaged in providing water transportation of passengers in coastal waters, the Great Lakes System (including the St. Lawrence Seaway), or deep seas between ports of the United States, Puerto Rico, and United States island possessions and protectorates. This industry sector includes many coastal and Great Lakes ferries used to travel short distances between coastal ports, or from shores to nearby islands, as well as larger vessels used on the Alaska Marine Highway, which travels between ports on the southern coast of Alaska and northwestern Canada (Reference for Business, 2007c).

As described above, most of the vessels involved in these activities are less than 79 feet and would therefore be addressed by the sVGP.

INLAND WATER TRANSPORTATION (NAICS 4832)

Businesses primarily engaged in providing inland water transportation of passengers and cargo on lakes, rivers, or intracoastal waterways (except on the Great Lakes System) are classified under this NAICS grouping, and are further classified between freight and passenger transportation (U.S. Census Bureau, 2007).

As required by the Jones Act, all vessels in this industry sector are domestic flagged and owned.

Inland Waterways Freight Transportation: NAICS 483211

The companies in this industry sector are primarily engaged in providing inland water transportation of cargo on lakes, rivers, or intracoastal waterways[22] (except on the Great Lakes System) (U.S. Census Bureau, 2007). This sector contains a large portion of the total number of vessels in the United States, as it encompasses river barges (generally more than 79 feet in

[22] The Intracoastal Waterway (ICW) is a 3,000-mile waterway running along the Atlantic and Gulf coasts of the United States. Composed of natural waterbodies (inlets, saltwater rivers, bays, and sounds) and artificial canals, it provides a navigable route along the coast and to several navigable rivers and inland ports.

length), as well as the tug and towboats that propel them (often in the 40- to 100-foot range) expected to be covered by the sVGP. The vast majority of boats in this sector overall are barges, which outnumber other inland freight vessels by about 10 to 1 (Transportation Institute, undated). Since barges tend to be more than 79 feet in length, however, vessels from this industry are outnumbered by commercial fishing vessels when considering only the vessels potentially subject to the sVGP (mostly the smaller tug and towboats).

The products carried by this industry sector include more than half of U.S. grain shipments, a quarter of chemical and petroleum exports, and a fifth of domestic coal shipments (Transportation Institute, undated). Barges account for 79 percent of domestic waterborne freight.

Inland waterways freight transportation, similar to Great Lakes and coastal water transportation, has experienced a decrease in cargo tonnage since 2006, although prior to this the total tonnage transported had remained constant over the past two decks (USACE, 2009). Nevertheless, inland waterways transport accounts for over 50 percent of all domestic waterborne freight shipments (USACE, 2009).

Inland Waterways Passenger Transportation: NAICS 483212

This industry sector provides inland water transportation of passengers on lakes, rivers, or intracoastal waterways (except on the Great Lakes System) (U.S. Census Bureau, 2007). This sector includes water taxis and ferries (except coastal and Great Lakes ferries), usually traveling short distances between inland ports, such as in New York harbor or in San Francisco Bay.

The ferry industry has been rebounding from historic lows in the 1970s, and short-distance ferries in urban areas have become alternatives to crowded highways and urban transit systems. In 2000, the 677 ferries operating in the United States served 578 destinations along 352 routes, transporting 113 million passengers (these figures include coastal and Great Lakes ferries) (Reference for Business, 2007c). Continued population growth in coastal metropolitan area coupled with increased vehicle traffic on the nation's highway systems, makes commuter passenger-vehicle ferries attractive transportation options in the future (U.S. Commission on Ocean Policy, 2004).

SCENIC AND SIGHTSEEING TRANSPORTATION, WATER (NAICS 4872)

This industry group comprises establishments primarily engaged in providing scenic and sightseeing transportation on water. The services provided are usually local and involve same-day return to place of origin (U.S. Census Bureau, 2007).

This sector encompasses a wide variety of vessel types, from small "swamp buggies" used to tour the Florida Everglades, to chartered dinner cruisers, sailing vessels, or whale-watching boats. The range of services offered has continued to expand over the past decade, with gambling boats becoming popular in Indiana and Iowa, and similar gaming "cruises-to-nowhere" becoming popular in Florida (Reference for Business, 2007d).

This leisure-based industry sector is more vulnerable to economic fluctuations, since its revenues draw on discretionary consumer spending. The global economic crisis and recession greatly reduced consumers' disposable income and thus their leisure spending (U.S. BEA, 2011a). It is likely that the scenic and sightseeing transportation sector was impacted by the recession.

SUPPORT ACTIVITIES FOR WATER TRANSPORTATION (NAICS 4883)

This NAICS grouping includes establishments classified in the following NAICS sectors: 48831, Port and Harbor Operations; 48832, Marine Cargo Handling; 48833, Navigational Services to Shipping and Salvage; and 48839, Other Support Activities for Water Transportation (U.S. Census Bureau, 2002).

Businesses in these sectors are the link between a vessel's load (cargo or passengers) and that load's final destination. This sector provides the highest percentage of employment in the industry, as many of these services are labor-intensive.

Port and Harbor Operations: NAICS 488310

Businesses in this industry sector operate ports, harbors (including docking, pier and waterfront terminal facilities), or canals (U.S. Census Bureau, 2002). Vessels in port and harbor operations may be involved in maintaining upkeep of harbor via dredging silt, clearing foreign debris, or assisting with construction projects (Reference for Business, 2007f). Vessels, such as tugboats, may also be responsible for assisting larger vessels in docking maneuvers in harbors and towing vessels. As of July 2002, there were 5,445 towboats in the entire U.S. fleet. The private tugboat industry experienced a boom in late 1990s when the U.S. Navy began chartering tugs instead of replacing its fleet (Reference for Business, 2007g).

Marine Cargo Handling: NAICS 488320

This industry comprises establishments primarily engaged in providing stevedoring and other marine cargo handling services (except warehousing) (U.S. Census Bureau, 2002). This sector contains only a small number of vessels, as most of its business is land-based.

This particular industry sector, along with port and harbor operations, has been growing over the last decade or two as a result of the increase in foreign trade, mostly with Asian countries. Marine cargo handling and port and harbor operations on the Pacific Coast account for about half of all such operations in the United States (Reference for Business, 2007e).

Despite the increase in volume of shipments handled, employment in marine cargo handling, as well as in port and harbor operations, has been on the decline in recent years, due to increased automation of tasks and other technological advances that reduce the need for manual labor. The industry's unions, the International Longshoremen's Association and the International Longshore and Warehouse Union, are nevertheless still strong and maintain high membership rates (Reference for Business, 2007e). Additionally, the decline in volume of shipments due to the recession undoubtedly impacted employment in these indirect industries.

Navigational Services to Shipping and Salvage: NAICS 488330

This NAICS classification includes two main types of businesses: navigational services to shipping and marine salvage (U.S. Census Bureau, 2007).

Vessels in this industry do not typically carry passengers or cargo, but rather assist larger vessels in entering and leaving port, or in other operations. The salvage subsector of this industry sector includes maintenance vessels that prepare ships for salvage and scrap.

Other Support Activities for Water Transportation: NAICS 488390

Other auxiliary services of the water transportation industry are grouped into this category, which includes maintenance, repair and salvaging of vessels, inspections, security, and other operations.

4.3.4 SUPPORT ACTIVITIES FOR MINING

The mining industry comprises establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. Within the mining industry, the drilling oil and gas wells and support activities for oil and gas operations sectors (NAICS 213111 and 213112, respectively) operate vessels covered by the sVGP, including a subset of the nearly 11,000 utility vessels identified in MISLE.

This sector comprises establishments primarily engaged in drilling oil and gas wells or performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Vessels are used primarily to support offshore and coastal drilling and production activities and their distribution therefore follows the distribution of near-shore and offshore oil and gas extraction activities. Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells (U.S. Census Bureau, 2007). Smaller vessels are also used to transport personnel and equipment to coastal and near-offshore locations.

The industry relies on offshore supply vessels or specialized industrial vessels to accomplish these activities. These vessels are classified as "utility vessel" in the MISLE database. Primary areas of operation are expected to follow major oil and gas production areas in the Gulf of Mexico, California, and Alaska.

As summarized earlier in *Table 4-3*, vessels less than 79 feet in length account for most (63%) of the utility vessels operating in U.S. waters.

In the remainder of this report, unless otherwise noted, the term *mining industry* refers more specifically to these two segments within the industry rather than the mining industry as a whole.

4.3.5 OTHER INDUSTRIES

Vessels addressed by the sVGP are associated with several other industry sectors. These include Other Heavy and Civil Engineering Construction (NAICS 2379), which comprises establishments engaged in dredging operations, and the development of marine facilities, among other activities.

The Scientific Research and Development Services (NAICS 5417) is associated with vessels used in physical and life sciences research (e.g., oceanography, marine ecology).

Remediation and Other Waste Management Services (NAICS 5629) include establishments engaged in remediation and waste management services. Most notably in the context of the sVGP, firms and organizations in this industry operate vessels involved in spill response and oil recovery operations.

The Other Amusement and Recreation Industries (NAICS 7139) industry sector includes marinas and similar establishments engaged in operating docking and/or storage facilities for pleasure

craft owners, with or without one or more related activities, such as retailing fuel and marine supplies; and repairing, maintaining, or renting pleasure boats. While recreational vessels are outside the scope of the sVGP, vessels operated for commercial purposes by marinas (e.g., launches for transporting persons from pleasure boats to shore) and similar establishments are potentially subject to the permit requirements.

A large number of vessels potentially subject to the sVGP are operated by establishments classified in the Administration of Economic Program (NAICS 9261) industry. These include tender, law enforcement, and other types of vessels operated by federal, state, and local government agencies and departments.

4.4 RECENT TRENDS

This section reviews the recent trends in the fishing and water transportation industries in terms of number of firms, numbers of vessels, and financial performance. It also highlights trends in the oil and gas production and drilling sectors of the mining industry.

Overall, from 2002 to 2007 there was a slight downward trend in number of firms for water transportation; however there were upward trends in total revenues, employment, and payroll. The fishing industry experienced an upward trend in the number of establishments, but a downward trend in employment (no data were available on the change in the commercial fishing vessels fleet during that time). The drilling oil and gas wells sector experienced relatively strong firm, revenue, and employment growth.

The reference period is from 2002 through 2007, the years of the two most recent Economic Censuses. There were no changes to the NAICS codes for these industries between these years.

Where Fishing Industry data was not available from the Census Bureau, it was taken from the SBA.

4.4.1 NUMBER OF ESTABLISHMENTS BY INDUSTRY SECTOR

Table 4-4 summarizes the changes in numbers of establishments for each sector of the water transport, fishing, and mining industries between 2002 and 2007. The Census defines an establishment as a single physical location where business transactions take place and for which payroll and employment records are kept. Each establishment, therefore, may operate one or more vessel.

As shown in the table, the water transportation industry experienced a decrease of 4.1 percent in the number of establishments over this period, though deep sea, coastal and great lakes water transportation experienced a much greater decline in number of establishments. Conversely, inland water transportation, and scenic and sightseeing transportation experienced a marginal increase in the number of establishments. Mining industry also experienced an increase in number of establishments.

Table 4-4: Number of Establishments by Industry Sector, 2002 and 2007.

NAICS Description	2002	2007	% Change
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	1,334	1,126	-16.0%
Inland Water Transportation	590	595	0.8%
Scenic and Sightseeing Transportation, Water	1,726	1,740	0.8%
Support Activities for Water Transportation	2,502	2,440	-2.5%
TOTAL-Water Transportation	*6,152*	*5,901*	*-4.1%*
Fishing Industry			
Fishing[a]	1,916	2,062	7.6%
Mining Industry			
Drilling oil & gas wells sector	1,926	2,109	9.5%

Source: U.S. Census Bureau, 2002a, 2002b, 2007a, 2007b;

[a] Based on reporting requirements for the data source, the number of establishments only includes firms with full-time employees. The number of commercial fishing vessel operators (see *Table 4-1*) is much larger, likely because they also include self-employed and seasonal fishermen.

The number of establishments presented in *Table 4-4* represents those establishments with paid employees. This number of considerably smaller than the number of managing owners of commercial fishing vessels potentially covered by the sVGP (up to 65,401, as shown in *Table 4-1*). It is also considerably smaller than the number of nonemployer establishments reported by the Census based on Internal Revenue Service data, summarized in *Table 4-5*. As shown in that table, there were 65,237 fishing establishments with no employees reported that year, each with average receipts of about $45,000. Based on this information, EPA assumes that a large fraction of the managing owners of commercial fishing vessels potentially covered by the sVGP consist of nonemployer establishments, e.g., individual proprietorships that operate a single commercial fishing vessel.

Table 4-5: Nonemployer Statistics for the Fishing Industries in 2008.

NAICS Description	Number of Establishments	Receipts ('000, 2008$)	Average Receipts per Establishment (2008$)
Fishing Industry			
All Establishments	65,237	2,926,929	$44,866
Corporations	3,754	584,479	$155,695
Individual Proprietorships	60,703	2,237,248	$36,856
Partnerships	780	105,202	$134,874

Source: U.S. Census Bureau, 2010. Statistics are based on tax return information of the Internal Revenue Service.

4.4.2 ESTABLISHMENT AND EMPLOYMENT BIRTHS AND DEATHS

Table 4-6 summarizes average establishment birth and death rates for each industry sector for which these data were available. The reference period for these trends is 2002–2007. Birth and death rates in the water transportation and fishing industries average between about 5 and 15 percent of their total numbers of establishments.[23]

For deep sea, costal and great lakes water transportation and support activities for water transportation, deaths outnumber births. However, for inland water transportation and scenic and sightseeing transportation births outnumber deaths. The largest average net change came in scenic and sightseeing transportation, water with an average of over 25 establishment births per year.

The fishing industry averaged a net change of eight establishment births per year between 2002 and 2007, while the support activities for mining sector averaged a net change of over 450 births per year between 2002 and 2007.

Table 4-6: Establishment Births and Deaths, Five-Year Annual Average: 2002-2007.

Industry Sector	Net Change	Births	Deaths
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	-9.8	133.8	143.6
Inland Water Transportation	9.6	90.0	80.4
Scenic and Sightseeing Transportation, Water	27.6	192.0	164.4
Support Activities for Water Transportation	-5.6	182.0	187.6
Water Transportation Industry Average	*6.7*	*184.7*	*178.0*
Fishing Industry			
Fishing	8.0	228.8	220.8
Mining Industry			
Support Activities for Mining [a]	458.6	1,155.6	697.0

[a] Data were only available for NAICS 213 (Support Activities for Mining) and were not available at the 6-digit NAICS level.

Source: U.S. SBA, 2007a

Table 4-7 summarizes the net change in employment (difference between births and deaths) for each industry sector for which these data are available. Specific information on job creation and elimination was not available for many industry sectors.

All the water transportation sectors had an average net gain of jobs over the five years. Support activities for water transportation averaged the largest change in employment per year, with an average of 2,111 jobs created per year. Scenic and sightseeing transportation also averaged more than 1,000 jobs created per year between 2002 and 2007. Inland water transportation and deep

[23] For the mining industry, the fraction is based on births and deaths relative to the 9,935 establishments reported in the 2007 Economic Census for NAICS 213 – Support activities for mining. According to the 2007 Economic Census, the drilling oil and gas wells sector (NAICS 213111) represented about a fifth (2,109 establishments) of the establishments reported in the support activities for mining sector (NAICS 213) that year.

sea, coastal and Great Lakes water transportation averaged net job creation rates of 573 and 510 employees per year, respectively.

The fishing industry averaged a reduction of 149 jobs per year over the same period whereas the support activities for mining sector (NAICS 213) averaged an increase of nearly 33,115 jobs per year. According to the 2007 Economic Census, the drilling oil and gas wells sector (NAICS 213111) accounts for a little under a third of the paid employees reported overall in the support activities for mining sector (NAICS 213) (106,859 paid employees as compared to 368,613 paid employees).

Table 4-7: Net Change in Employment: Five-Year Annual Average, 2002-2007.

Industry Sector	Net Change
Water Transportation Industry	
Deep Sea, Coastal, and Great Lakes Water Transportation	509.8
Inland Water Transportation	573.2
Scenic and Sightseeing Transportation, Water	1,058.8
Support Activities for Water Transportation	2,111.6
Water Transportation Industry Average	*983.9*
Fishing Industry	
Fishing	-149.2
Mining Industry	
Support Activities for Mining [a]	33,115.0

a Data were only available for NAICS 213 (Support Activities for Mining) and were not available at the 6-digit NAICS level. The number of paid employees reported for NAICS 213 in the 2007 Economic Census is 368,613.

Source: U.S. SBA, 2007a

4.4.3 FINANCIAL PERFORMANCE

Overall, the water transportation industry experienced robust growth of 22 percent over the period 2002–2007 (see *Table 4-8),* which is more robust than the overall U.S. economy's growth of 15 percent during this period (U.S. BEA, 2011b). There was significant variability in the performance of the various industry sectors, with revenues increasing 106 percent in inland water transportation and 20 percent in deep sea, coastal and Great Lakes water transportation sectors. None of the water transportation industries saw a decrease in revenue.

The drilling oil and gas wells sector experienced an increase of almost 115 percent over the same period.

No revenue data were available for the fishing industry in 2007. Instead EPA found data on total value of commercial fish landings in 2007 and used these data as proxy for revenues. Other industry data—employment, payroll—are from the U.S. Small Business Administration and the Census' County Business Patterns dataset because fishing is not included in the Economic Census.

Table 4-8: Revenues by Industry Sector, 2002 and 2007.

Industry Sector	2002 ($ millions)[a]	2007 ($ millions)	Percent Change
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	$23,778	$28,513	19.9%
Inland Water Transportation	$2,873	$5,934	106.5%
Scenic and Sightseeing Transportation, Water	$1,111	$1,271	14.4%
Support Activities for Water Transportation	$11,296	$12,128	7.4%
TOTAL-Water Transportation	*$*39,058	*$*47,845	22.5%
Fishing Industry			
Fishing [b]	$3,646	$4,199	15.2%
Mining Industry			
Drilling oil & gas wells sector	$10,450	$22,512	115.4%

Source: U.S. Census Bureau, 2002b, 2007a; U.S. SBA, 2002b; NOAA, 2011a

[a] 2002 Economic Census revenue data updated to $2007 by using Consumer Price Index (CPI) deflator (US BLS, 2011). All data in $2007.

[b] No revenue data are available for the commercial fishing industry in the Economic Census 2007. The 2007 value of fish landing is used as a proxy of revenue for that industry. For consistency, revenue for 2002 are also based on the value of fish landing.

4.5 INDUSTRY MARKET STRUCTURE

The fishing and water transportation industries, and the drilling oil and gas wells segment of the mining industry are comprised of a large number of small businesses, whether classified by employment size or by annual revenues. The vast majorities of firms in these industries employ fewer than 100 people and earn revenues of less than $1 million per year.

This large concentration of small firms earning relatively low amounts of revenue may make the water transportation and fishing industries, and the drilling oil and gas wells segment of the mining industry more sensitive to changes in operating costs.

4.5.1 FIRMS AND REVENUES

Table 4-9 details the number of firms and revenues by employment size in 2007. In the water transportation industry, 78 percent of firms employ fewer than 20 people, though these firms only account for 6 percent of the industry's revenue. Large firms employing more than 500 people, on the other hand, account for only 1 percent of businesses in the industry, but earn nearly a quarter of its revenue.

The drilling oil and gas wells sector also contains a larger percentage of firms employing fewer than 20 people (68 percent), and these firms account for only a tiny share of total industry revenue (3 percent). The large firms in this sector account for approximately 2 percent of total firms, but earn over 30 percent of the sector's revenue. Firms not operating the entire year do not report employment data, and are classified under "NR" in the table. There are large numbers of these in the water transportation industry. The drilling oil and gas wells and fishing sectors do not distinguish between firms operating year round and those operating part-time.

In the fishing industry, the vast majority of firms (97 percent) employ fewer than 20 people. Less than 0.1 percent of fishing firms employ over 500 people. The share of small firms may be even greater, however, since nonemployer statistics suggest that firms without employees outnumber those with at least one paid employee by a ratio of over 30 to 1 (about 65,000 compared to 2,000). Unfortunately, Census data on the fishing industry are generally not detailed enough to allow a distribution of the firms by revenue category.

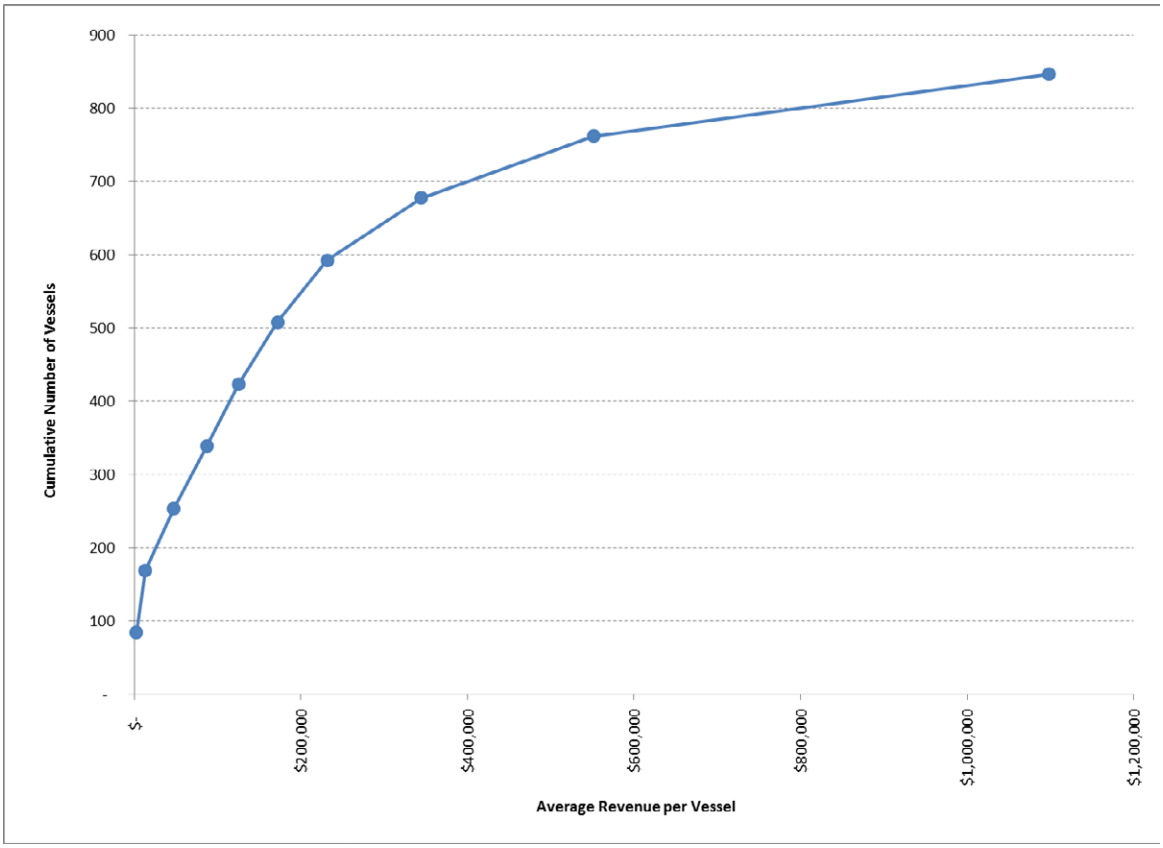
Statistics available from other sources regarding revenue to commercial fishermen by region and type of catch or operational configuration offer some insight on the distribution of revenue in the fishing industry. For example, data for California salmon and Dungeness crab fisheries suggest average revenue per vessel ranging from $23,142 for small vessels to $75,715 for medium and large vessels ($25,031 to $81,897 in 2010 dollars) (Hackett and Hansen, 2008). Data for northeast multispecies (groundfish) fisheries [24]show average per vessel revenue in 2010 of $16,509 for vessels less than 30 feet, $128,907 for vessels between 30 and 50 feet, and $333,323 for vessels between 50 and 75 feet (NOAA, 2011b).[25] The majority of northeast groundfish vessels (440 out of the total 847 active vessels) were in the 30 to 50 feet category, while there were 226 active vessels between 50 and 75 feet and only 33 vessels less than 30 feet. Revenues vary within each of the size categories, however, and across the overall fleet. This is illustrated in *Figure 4-1*, which shows the cumulative distribution of revenue for the groundfish vessel fleet in the Northeast in 2010. Each point on the chart corresponds to the average revenue for a given vessel decile (e.g., the chart shows that 60 percent of vessels (508 vessels) have average revenues less than $172,176).

The same source provides statistics on the average revenue per trip for vessels of different sizes. For vessels less than 30 feet, the average revenue per trip ranges between $384 and $734 for groundfish and non groundfish trips, respectively, with each trip averaging 0.35 to 0.38 days.

[24] Includes cod, winter flounder, with flounder, yellowtail, American plaice, haddock, hake, redfish, and pollock.

[25] Per vessel revenue standard deviations were quite large for all vessel categories: $40,963 for vessels less than 30 feet; $117,891 for vessels 30-50 feet; $298,878 for vessels 50-75 feet.

Figure 4-1: Cumulative Distribution of per Vessel Revenue, Northeast Groundfish Vessels Active in 2010 (Source: NOAA, 2011b).



Permit data for Alaska fisheries show similarly wide variability in average revenue per active permit, illustrated in *Figure 4-2*. Average revenues for 2010 ranged from less than $2,000 for the lower quartile of permits holders for halibut fishing by hand troll, to nearly $2.5 million for the upper quartile of permits holders for king crab fishing (Alaska Commercial Fisheries Entry Commission, 2011). Within each type of Alaskan fishery (catch, type of equipment, or region), the ratios of revenues earned by the top quartile permit holders and those earned by the bottom quartile permit holders can be as high as twenty to one. In general, larger vessels (60 feet or greater in length) have higher revenue than smaller vessels.

As the two fisheries data sets show, there is considerable variability in per vessel revenue reported, depending on the type of fishery and vessel characteristics. This variability has implications for understanding the distribution of revenue among firms with vessels covered by the sVGP, particularly among the smaller firms.

Thus, although fishing is a seasonal occupation in many regions and annual revenue may therefore be lower than if it were conducted throughout the entire year, the very low revenue reported for certain smaller vessels (below fuel costs) and the small number of days fished, suggest that there is a fraction of commercial permit holders for which commercial fishing may not be a primary economic activity.

In addition, the estimated population of fishing vessels covered by the sVGP includes vessels less than 26 feet. As discussed earlier in *Section 2.1.1*, these vessels may have been originally manufactured as pleasure crafts, but used in commercial fishing activities. On the basis of their definition as recreational vessels under the CBA, however, these vessels are not covered by the sVGP. Therefore, revenue for small vessels is not necessarily indicative of the types of firms that would incur incremental costs as a result of sVGP compliance.

We discuss the implications of these two factors when considering the distribution of impacts among firms of different size in *Section* 6 of this report.

Table 4-9: Firms and Revenues by Employment Size, 2007.

Number of Employees	Number of Firms					Revenues ($ millions)				
	1-19	20-99	100-499	500+	NR[1]	1-19	20-99	100-499	500+	NR
Water Transportation										
Deep Sea, Coastal, Great Lakes Water Transportation	461	133	68	18	126	1,119[2]	2,090	7,671	3,389[2]	163
Inland Water Transportation	321	78	35	5	109	335[2]	678	1,667	2,664	D[3]
Scenic and Sightseeing Transportation, Water	933	103	8	2	656	410	379	D[3]	D[3]	218
Support Activities for Water Transportation	1,287	271	82	27	239	1,154	2,503	2,700	5,589	181
TOTAL-Water Transportation	3,002	585	193	52	1,130	3,019	5,649	12,037	11,642	563
Percentage of Industry	*78.3%*	*15.3%*	*5.0%*	*1.4%*	*29.5%*	*6.3%*	*11.8%*	*25.2%*	*24.3%*	*1.2%*
Fishing										
Fishing[4]	2,002	37	11	3	--	--	--	--	--	--
Percentage of Industry	*97.5%*	*1.8%*	*0.5%*	*0.1%*	--	--	--	--	--	--
Mining Industry										
Drilling oil & gas wells sector[5]	1,454	439	180	36	--	632	4,011	8,382	7,721	--
Percentage of Sector	*68.9%*	*20.8%*	*8.5%*	*1.7%*	--	*2.8%*	*17.8%*	*37.2%*	*34.3%*	--

Source: U.S. Census Bureau, 2007; U.S. SBA, 2007b

Notes:

1. NR = Firms that do not report revenue or employment data because they do not operate the entire year.
2. Revenue data are not complete; some revenue data was not included in data set due to disclosure concerns.
3. D = data withheld to avoid disclosing data for individual companies.
4. Data only include firms with employees, which represent only a small subset of fishing industry establishments.
5. Revenue data for NAICS code 213111 taken from “total value of shipments and receipts for services” representing gross sales.

Figure 4-2: Distribution of Average Earnings of Holders of Commercial Fishing Permits in Alaska in 2010, by Permit Type (Catch, Equipment, and Region) (Based on data from Alaska Commercial Fisheries Entry Commission (2011)).

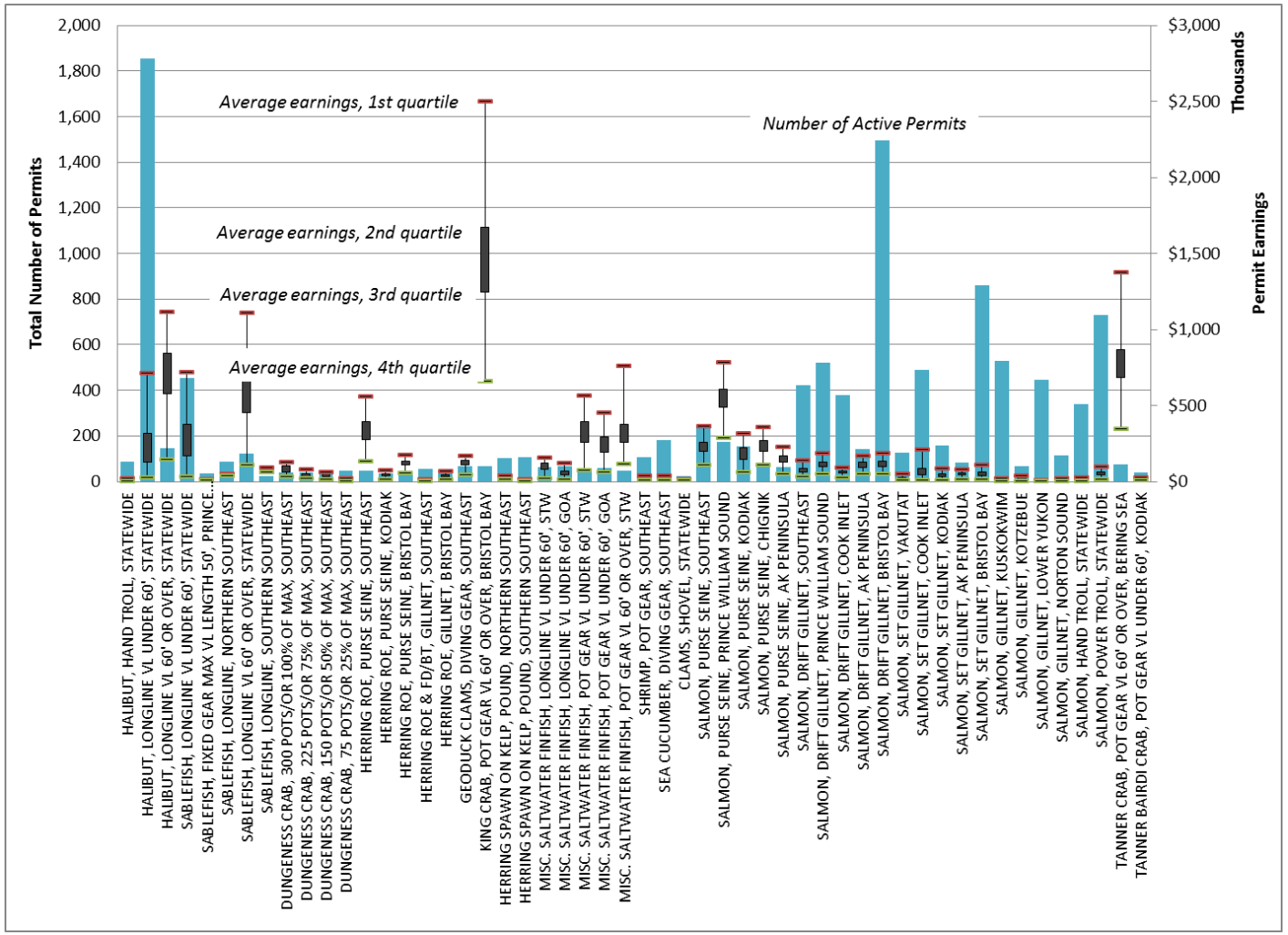


Table 4-10 details the number of firms according to annual revenue in each sector of the water transportation industry (revenue data are not available for the fishing and mining industry). As shown in the table, firms earning less than $1 million per year account for 65 percent of the industry's firms, and firms earning between $1 and $5 million add another 21 percent. A large majority (86 percent) of firms are thus earning revenues less than $5 million.

Similarly detailed data are not available for the fishing and relevant subset of the mining industry. However, nonemployer statistics described above suggests that the vast majority of the firms in this industry have annual revenue less than 1 million dollars.

While no data could be found for 2007, 2002 data for the drilling oil and gas wells segment of the mining industry suggested that 77 percent of all firms earned less than $1 million in revenues and approximately 95 percent earned less than $5 million in that year (U.S. Census Bureau, 2002). EPA has not found indication that the general distribution of firms by revenue size has changed significantly since 2002.

Table 4-10: Number of Firms According to Revenue Size.

	Number of Firms				
Revenues (millions of dollars)	**<1[a]**	**1-5**	**5-25**	**25-100**	**100+**
Water Transportation					
Deep Sea, Coastal, and Great Lakes Water Transportation	284	180	113	56	47
Inland Water Transportation	227	120	59	21	12
Scenic and Sightseeing Transportation, Water	834	178	31	3	0
Support Activities for Water Transportation	998	402	188	57	22
TOTAL-Water Transportation	*2,343*	*880*	*391*	*137*	*81*
Percentage of Industry	*61%*	*23%*	*10%*	*4%*	*2%*
Fishing Industry					
Fishing	ND	ND	ND	ND	ND
Percentage of Industry	ND	ND	ND	ND	ND
Mining Industry					
Drilling oil & gas wells sector	ND	ND	ND	ND	ND
Percentage of Sector	ND	ND	ND	ND	ND

Source: U.S. Census Bureau 2007b

[a] The Economic Census breaks down this category further into firms with revenue less than $100,000; $100,000 to $249,999; $250,000 to $499,999; and $500,000 to $999,999.

ND: No data available on distribution of establishments by revenue size

4.5.2 SMALL BUSINESSES

The U.S. SBA defines small businesses for the various sectors of these industries as follows:

- *Fishing*: revenues less than $4 million
- *Deep sea, coastal, and Great Lakes water transportation; inland water transportation*: fewer than 500 employees
- *Scenic and sightseeing transportation; navigational services to shipping and salvage; other support activities for water transportation*: revenues less than $7 million
- *Port and harbor operations; marine cargo handling*: revenues less than $25.5 million
- *Drilling oil and gas wells sector*: fewer than 500 employees

- *Support activities for oil and gas operations*: revenues less than $7 million (U.S. SBA, 2010).

Table 4-11 summarizes the number of small businesses in each sector of the water transportation, fishing, and mining industries. On the whole, all industries contain more than 90 percent small businesses. Inland waterways freight transportation, the industry sector encompassing barges, has the lowest number of small businesses, which may also contribute to its high number of vessels per establishment.

These percentages were calculated based on the number of employer firms operating the entire year, as employment figures are not available for firms operating only part of the year.

As discussed above, the number of establishments in the commercial fishing industry is much larger when including nonemployer statistics (and entities that may operate only seasonally). Including these entities means that practically 100 percent of firms in the industry are considered small, according to the SBA definition.

Table 4-11: Small Businesses by Industry Sector.

Industry Sector	Small Business Threshold	Firms Operated Entire Year	Small Businesses	Percent Small Business
Water Transportation Industry				
Deep Sea, Coastal, and Great Lakes Water Transportation				
Deep Sea Freight Transportation	500 Employees	188	183	97.3%
Deep Sea Passenger Transportation	500 Employees	41	38	92.7%
Coastal and Great Lakes Freight Transportation	500 Employees	344	336	97.7%
Coastal and Great Lakes Passenger Transportation	500 Employees	123	122	99.2%
Subtotal-Deep Sea, Coastal, and Great Lakes		*696*	*679*	*97.6%*
Inland Water Transportation				
Inland Waterways Freight Transportation	500 Employees	264	259	98.1%
Inland Waterways Passenger Transportation	500 Employees	176	176	100.0%
Subtotal-Inland		*440*	*435*	*98.9%*
Scenic and Sightseeing Transportation, Water				
Scenic and Sightseeing Transportation, Water	$7 million	1,046	1,012	96.7%
Support Activities for Water Transportation				
Port and Harbor Operations	$25.5 million	197	172	87.3%
Marine Cargo Handling	$25.5 million	262	222	84.7%
Navigational Services to Shipping and Salvage	$7 million	640	545	85.2%
Other Support Activities for Water Transportation	$7 million	626	572	91.4%
Subtotal-Support Activities		*1,725*	*1,511*	*87.6%*
TOTAL-Water Transportation		*3,907*	*3,637*	*93.1%*
Fishing Industry				
Fishing [a]	$4 million	1,916	1,843	96.2%
Mining Industry				
Drilling oil & gas wells sector	500 Employees	2,109	1,893	89.8%

Source: U.S. Census Bureau, 2007

[a] *Includes only employer firms. Nonemployer statistics suggest that the vast majority of firms in the fishing industry earn significantly less than $4 million annually.*

4.5.3 EMPLOYMENT AND PAYROLL

Employment in the water transportation increased by seven percent while employment in the fishing industries declined by 14 percent over the period between 2002 and 2007 (see *Table 4-12: Employment by Industry Sector, 2002-2007.).* However, payroll in both industries increased despite the decline in fishing employment numbers. In fact, all sectors within the water transportation industry grouping saw an increase in payroll, including support activities for water transportation which experienced a slight (two percent) decrease in employment. Employment and payroll in the drilling oil and gas wells sector increased by 76 percent and 108 percent, respectively, over the same period.

Note that these figures, and those discussed in the rest of this section, reflect the detailed data available from the most recent Economic Census. They do not capture the impact of the subsequent recession which likely reduced employment and payroll in these sectors, as in many other sectors of the U.S. economy.

TOTAL NUMBER OF EMPLOYEES BY INDUSTRY SECTOR

In 2007, the water transportation industry employed about 157,000 people. Nearly half of these people (44 percent) were employed by businesses providing support activities for water transportation. Another third worked in the deep sea, coastal, and Great Lakes water transportation sector, with the remaining 20 percent being split between inland water transportation and scenic and sightseeing transportation on water. The fishing industry employed about 5,600 people in 2007, while the drilling oil and gas wells employed about 107,000 people.

Overall, the water transportation industry saw a 7.3 percent increase in its number of employees between 2002 and 2007. The drilling oil and gas wells sector saw a large (77 percent) increase in employment. The only industry to experience a decline was the fishing industry which had a 14.3 percent decline in employment. Overall, the U.S. unemployment rate decreased from 6.0 percent to 5.0 percent between 2002 and 2007 (U.S. BLS, 2011).[26]

Deep, sea, coastal and Great Lakes transportation, inland water transportation and scenic and sightseeing transportation, water all had increases in employment. The largest increase was in the inland water transportation sector, where employment increased almost by half. Deep, sea, coastal and Great Lakes transportation and scenic and sightseeing transportation both increased by about 10 percent. All these sectors saw huge increases in revenue, including support activities for water transportation which had a 1.7 percent decline in employment, but a 23 percent increase in revenue.[26]

[26] Note that these statistics represent changes between 2002 and 2007, the latest year for which detailed Economic Census data are available. The data pre-date the recession and therefore do not reflect the subsequent drop in overall employment across most sectors of the U.S. economy.

Table 4-12: Employment by Industry Sector, 2002-2007.

Meaning of 2002 NAICS code	2002 Number of Employees	2007 Number of Employees	Percent Change
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	52,009	56,398	8.4%
Inland Water Transportation	13,317	19,599	47.2%
Scenic and Sightseeing Transportation, Water	11,557	12,692	9.8%
Support Activities for Water Transportation	69,569	68,396	-1.7%
TOTAL-Water Transportation	*146,452*	*157,085*	*7.3%*
Fishing Industry			
Fishing	6,537	5,600	-14.3%
Mining Industry			
Drilling oil & gas wells sector	60,450	106,859	76.8%

Source: U.S. Census Bureau, 2002a, 2002b, 2007a, 2007b

PAYROLL BY INDUSTRY SECTOR

Payroll in the water transportation and fishing industries rose by almost 18 percent and 4 percent, respectively, from 2002 to 2007 (see *Table 4-13).* Consistent with the large increase saw in employment, the drilling oil and gas wells sector also saw a large increase in payroll, with payroll increasing by 108 percent.

No sectors profiled below saw any decrease in payrolls. Generally every sector saw large increases, with the most modest increase at 20 percent in support activities for water transportation. Inland water transportation saw the largest increase in the water transportation sector with 78 percent increase in payroll.

The fishing industry's payroll rose by a robust about 4 percent, despite a relatively large 14 percent decrease in its employment base.

Table 4-13: Payroll by Industry Sector, 2002-2007.

Industry Sector	2002 Annual Payroll ($ millions)[a]	2007 Annual Payroll ($ millions)	Percent Change
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	$2,809	$3,486	24.1%
Inland Water Transportation	$685	$1,059	54.5%
Scenic and Sightseeing Transportation, Water	$307	$350	13.8%
Support Activities for Water Transportation	$3,186	$3,338	4.8%
TOTAL-Water Transportation	*$6,987*	*$8,233*	*17.8%*
Fishing Industry			
Fishing	$291	$302	3.8%
Mining Industry			
Drilling oil & gas wells sector	$2,871	$5,984	108.4%

Source: U.S. Census Bureau, 2002a, 2002b, 2007; U.S. SBA, 2007b

[a] 2002 Economic Census revenue data updated to $2007 by using Consumer Price Index (CPI) deflator (US BLS, 2011). All data in $2007.

5 COST OF EFFLUENT LIMITS AND RELATED REQUIREMENTS

5.1 SUMMARY

The first step in assessing costs of the new NPDES permitting requirements was determining the population of vessels that will be affected by the Permit. As detailed in *Section* 2*,* the total population of domestic vessels is as high as 138,000 vessels, and the total population of foreign vessels is 112. NPDES requirements for discharges incidental to the normal operation of a vessel will impact virtually every commercial fishing vessel and other non-recreational vessel less than 79 feet in length. However, some vessels will be implementing only certain management practices or activities because some discharges are not applicable to all vessel types. For example, practices associated with graywater discharges are not applicable to barges since this vessel class does not produce this type of discharge (e.g., they do not have a galley), while practices associated with fish hold discharges only apply to commercial fishing vessels.

To estimate the effect of the sVGP on the industry as a whole, a baseline must be identified from which to measure this effect. The baseline takes into account previous conditions and determines how the industry would act in the future in the absence of the Permit. The baseline for this analysis is full industry compliance with existing federal and state regulations; and current industry practices or standards that exceed current regulations to the extent that they can be empirically observed.

As summarized in *Section* 3, a number of laws and associated regulations (including NISA; APPS; the Comprehensive Environmental Response, Compensation, and Liability Act; the Organotin Anti-fouling Paint Control Act; Regulations of the Discharge of Oil; EPA's Vessel General Permit for ballast water discharges; and others) already cover certain discharges that would be subject to the new permitting regime. In analyzing economic impacts of sVGP, EPA has assumed that the entities subject to existing regulations will not incur significant incremental costs.

The second step in assessing costs of the new NPDES permitting requirements is establishing per-vessel (or per-firm) costs for each management practices. Some of these costs are derived from industry communication and survey responses compiled as part of the development of the VGP (EPA, 2008). Additional cost inputs were obtained from manufacturers and field experts. Per-vessel costs are established for the discharge categories in which vessels are expected to incur incremental costs. The annual per-vessel cost of each required practice is estimated based on the per-instance cost of performing each practice the number of times per year the practice needs to be performed.

Several practices that may be implemented to comply with requirements under each discharge category were not analyzed for incremental costs because (1) the industry is already complying with the requirement or (2) the expected cost of the relevant practice is negligible.

Finally, the total annual cost per discharge category is estimated by multiplying the cost of each compliance activity or practice per vessel by the number of vessels expected to incur incremental costs due to the sVGP requirements.

5.2 METHODOLOGY

The approach to estimating the incremental compliance cost consists of four general steps, applied to each of the discharge categories in this section:

- *Step 1*: Review the sVGP requirements to identify those that may involve incremental practices beyond what vessel owners are currently doing to comply with existing laws and regulations or as part of their current operating practices.
- *Step 2*: Estimate the number of vessels that will implement the practices identified in Step 1 during the five years of the permit. This accounts for discharges that are applicable to different types of vessels. As appropriate, the estimated number of vessels also takes into account the fraction of vessels that may already be implementing a practice.
- *Step 3*: Estimate the incremental annual compliance cost to each vessel owner. This cost considers equipment or labor costs and the frequency with which a practice may be conducted each year. Some of the sVGP requirements involve a change in customary operating practices and involve the use of material or equipment or additional labor hours. EPA estimated the cost of individual practices based on information obtained from industry representatives, outside research as well as additional data sources. For practices involving additional labor, EPA used the same industry average labor rates used in the previous economic analysis of the VGP, updated to 2010 dollars using the Employment Cost Index (ECI). These rates are multiplied by the incremental number of hours estimated to be necessary to implement the practice. If any of the practices require equipment purchase, costs are annualized considering the life of the equipment, assuming a discount rate of 7 percent (OMB, 2009).
- *Step 4*: Calculate the total annual compliance costs by multiplying the number of vessels by the annual per vessel compliance costs (these costs include annualized capital costs, if any).

The sections below go through these steps for each of the major discharge categories contained in the sVGP.

5.2.1 GENERAL REQUIREMENTS

PERMIT REQUIREMENTS

To comply with requirements pertaining to this category, vessel owners must ensure that discharges from their vessel meet the following standards:

(a) Minimize the potential for substances or pollutants to accidentally enter the effluent, including spills.

(b) May not contain visible garbage in the effluent.

(c) May not use any dispersants, cleaners, chemicals, or other materials or emulsifiers that would remove the appearance of a visible sheen .

(d) Minimize the introduction of constituents of concern or pollutants, such as foam or floating solids.

(e) Oil, including oily mixtures, may not be discharged in quantities that may be harmful or cause a visible sheen.

(f) The discharge of antifreeze into waters subject to this permit must be minimized. For vessel engines that have been winterized, minimization can be achieved by draining antifreeze from the engine prior to startup or

capturing antifreeze when discharged from the engine upon startup. The discharge of antifreeze with toxic or known carcinogenic additives, such as ethylene glycol and methanol, is prohibited.

(g) When feasible, cleaning, maintenance, and repair jobs should be done while the vessel is out of the water or in drydock.

(h) Any soaps, detergents or cleaners used must be non-toxic, phosphate-free, and biodegradable. Phosphate-free soap contains by weight 0.5% or less of phosphates or derivatives of phosphates.

(i) Any spill of oil or other harmful chemicals that are discharged in a quantity that may be harmful or cause a visible sheen as established under 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, must be reported immediately to the National Response Center at 1-800-424-8802. The National Response Center can also be contacted through their website at: www.nrc.uscg.mil.

Many of the requirements listed under this category are already required under other regulations, such as provisions contained in 40 CFR part 110 regarding discharges of oil or other prohibitions under the CWA, or are common practices already being implemented by vessel owners.

For example, EPA assumes that vessels already avoid discharging oil or oily mixtures given the existing requirements of 40 CFR 110 which prohibits harmful discharges of oil, where harmful is defined as any discharge that violates water quality standards or causes a film or sheen or discoloration of surface water. 40 CFR 110 also bans the use of dispersants or emulsifier to "circumvent the provisions," and thus vessels are already assumed not to be using dispersants, cleaners, chemicals or other products to remove a sheen. Additionally vessels are already assumed to be minimizing introduction of pollutants or substances such as foam, floating solids or those that cause a visible sheen.

Under the Clean Water Act, it is unlawful to discharge any pollutant from a point source without a permit. The definition of pollutant includes garbage and illegal substances (these were not considered incidental discharges); thus vessels discharges are assumed not to include garbage or any substances banned by U.S. law as these were not previously authorized. The provisions of the Clean Water Act also address accidental discharges and require spill prevention, and thus vessels will incur no cost to "prevent substances or pollutants from accidentally enter effluent and prevent spills into effluent." Similarly, the requirement that antifreeze not be discharged into any water body is assumed to impose no incremental cost on vessel owners since alternative disposal methods are readily available and EPA assumes that vessels owners already comply with the requirement given CWA existing discharge prohibitions. Furthermore, the two constituents of antifreeze specifically identified in the permit requirement, ethylene glycol and methanol, are both defined as hazardous substances under the CWA.

Also EPA assumes that significant maintenance, cleaning and repair jobs are already done out of the water when feasible given current practices that involve hauling out boats regularly to conduct a variety of vessel maintenance tasks and guidance provided by most marinas and harbors on activities that may not be performed on water.

One requirement that could potentially involve incremental costs to vessel owners is the one specifying the use of non-toxic and phosphate-free soaps. The cost implications of this are discussed below.

AFFECTED VESSEL POPULATION

Based on the general nature of practices within this discharge category, general requirements are potentially applicable to all 115,000 to 138,000 non-recreational vessels less than 79 feet. However, as described above, EPA generally expects that most of the practices listed in this category are already widely implemented the vessels addressed by the sVGP.

COST ESTIMATES

To evaluate whether the practices listed in this discharge category have the potential to impose incremental costs on vessel owners, EPA gathered information on the cost difference between "green" and conventional boat cleaning products; in particular the cost of phosphate-free and safer/clean products that carry third-party certification, compared to the cost of conventional cleaning products without such third-party certification. EPA found that there was no systematic cost difference between soaps certified by third parties as more "environmentally friendly" and conventional products; in fact, the certified "green products" were often less expensive. Based on a review of retail prices for 32 unique boat soaps , EPA found that the average per-unit cost of certified cleaners ($20.27/gallon) was slightly less than the average per-unit cost of non-certified, conventional cleaners ($20.98/gallon) (prices taken from West Marine, Jamestown Distributors, Amazon.com and Greenboatstuff.com, see Appendix A for source data). EPA could find no evidence that the certified cleaners are less effective. Based on these findings, EPA assumes that the sVGP requirement to use non-toxic, phosphate-free soaps does not result in an incremental cost.

Given that other practices listed in this category of the sVGP are already being implemented by vessels, EPA assumes that requirements listed under this discharge category will not result in incremental costs.

5.2.2 FUEL MANAGEMENT

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

> *(a) All motorized vessels constructed on or after December 19, 2013 must have a functioning fuel-air separator or a fuel tank vent to prevent a fuel spill.*
>
> *(b) Prevent overfilling and do not top off your fuel tanks.*
>
> *(c) For motorized vessels, if the vessel does not have a functioning fuel-air separator or a fuel tank vent, you must use an oil absorbent material or other appropriate device while fueling the vessel to prevent any oil from entering waters subject to this permit.*
>
> *(d) Regularly inspect the fuel and hydraulic systems for any damage or leaks.*
>
> *(e) Unless impracticable, fill portable tanks onshore, instead of on the dock or on your vessel.*

While many of the fuel management requirements are part of proper boating procedure and thus have no incremental cost, vessels will potentially incur incremental cost for a fuel-air separator or tank vent (in the case of a new vessel) or use of oil absorbent material (in the case of existing vessels not already equipped with a fuel-air separator or tank vent). The implications of these two requirements are discussed below.

AFFECTED VESSEL POPULATION

New Vessels

Under the requirements, all new commercial vessels less than 79 feet in length constructed after December 19, 2013 will be required to have a fuel-air separator system (FASS) or tank vent to prevent spilling of fuel. According to standards already promulgated by EPA under 40 CFR 1060, all new boats built after 2012 that use gasoline as fuel will be equipped with new fueling equipment to prevent spilling of fuel and therefore

automatically comply with the sVGP requirement. The requirement to install a fuel air separator on all new vessels would therefore only impose an incremental cost for vessels not already subject to the standards: new diesel vessels.

EPA used the shares of gasoline- vs. diesel-fueled non-recreational vessels to estimate how many new vessels would likely need to install a FASS to comply with the sVGP. Information provided in U.S. EPA (1998; 2010) on the characteristics of non-recreational vessels suggests that nearly 100 percent of commercial fishing vessels are diesel fueled. Accordingly, assuming that new vessels have similar characteristics as the existing fleet, all new fishing vessels may be diesel fueled and could be required to install a FASS. The same sources suggest that possibly as many as 90 percent of all non-fishing non-recreational vessels use diesel engines (U.S. EPA 1998, 2010).

To estimate the number of new vessels potentially covered by the sVGP, EPA assumed that the average life of a non-recreational vessel is 30 years (Abt Associates, 2008) and about $1/30^{th}$ of the vessel fleet may be replaced by new vessels each year, assuming a constant vessel population. Based on these assumptions, of the 4,661 new vessels subject to the sVGP each year, the subset of vessels with diesel engines (100 percent of fishing vessel and 90 percent of other vessels) that will be required to install a fuel air separator system is shown in *Table 5-1*.

Table 5-1: Universe of Vessels Requiring Installation of Fuel Air Separator System (FASS).

Type of Vessel	Total Number of Existing Vessels (lower/upper bound estimate)	Proportion New Per Year	Percent Diesel	Number of New Vessels Requiring FASS Per Year (lower/upper bound estimate)
Commercial fishing vessels	67,178 - 67,713	1/30	100%	2,239 - 2,257
Other non-recreational vessels	43,243 - 60,931	1/30	90%	1,297 - 1,828

Source: U.S. Coast Guard, MISLE database, 2009

EPA further assumes that the distribution of new vessels by size category will follow that observed in the baseline, namely 11 percent of commercial fishing vessels are less than 26 feet, 72 percent are between 25 and 50 feet, and 16 percent are more than 50 feet. In the case of other non-recreational vessels, the shares are 20 percent, 52 percent, and 28 percent, respectively.

Existing Vessels

All existing vessels not already equipped with a fuel-air separator or tank vent will be required to utilize oil pads for fuel management. EPA assumes that existing vessels are not currently equipped with a fuel-air separator (this is likely to be a conservative assumption given the wide availability of this equipment); this permit will not require that existing vessels install equipment; instead, owners of existing vessels may comply with permit requirements by using oil absorbent material during fueling to catch drips and prevent spills.

Since only self-propelled vessels may be expected to conduct fueling activities as part of their normal operations, vessels subject to these requirements are expected to comprise all existing vessels except barges (barges often have no engine but are instead towed by another vessel (EPA, 2010b)). According the vessel population derived from MISLE data, the number of vessels potentially subject to this requirement ranges from about 110,000 to over

128,000, as presented in *Table 5-2*.[27] Note that while existing vessels will be progressively replaced by new vessels as described above, for the purpose of this estimate, EPA is using the total population of existing vessels as a conservative estimate of the vessels that may incur incremental cost during any one year of the five years of the Permit.

Table 5-2: Vessel Counts for Oil Pad Requirements for Fuel System Management

Vessel Class	Vessel Count (Lower Bound Estimate)	Vessel Count (Upper Bound Estimate)
Commercial Fishing Services	67,178	67,713
Freight Ships	579	768
Passenger Vessels	18,660	20,953
Public Vessels, Unclassified	67	622
Tank Ships	49	179
Utility Vessels	8,876	11,034
Unspecified	15,012	27,375
TOTAL	**110,421**	**128,644**

COST ESTIMATES

Fuel Air Separators

In order to determine the costs of the fuel air separator system, EPA contacted leading boating suppliers, and found a range of costs for these systems (Boatstore.com; Boater's World; PBS Supply Store; West Marine Supply). Unit costs per FASS ranged from $50 to $930 for the one-time cost of purchasing and installing the system. In general, the range reflects differences in vessel and engine sizes or configuration. A small commercial boat with an outboard motor will pay significantly less for purchasing and installing a FASS than a 70-foot commercial fishing vessel. The cost for FASS often also depends on the engine horsepower. Amortizing this cost over the 30-year assumed life of a vessel is equivalent to an annual cost of $4 to $75 per vessel.[28] For the purpose of the analysis, EPA assumed that vessels less than 26 feet incur a cost equal to the lower range estimate ($50), vessels greater than 50 feet would incur the maximum cost ($930), and vessels between 26 and 50 feet incur the average cost ($490).

Table 5-3 shows the total costs for this requirement on an upfront and annualized basis.

[27] The population depends on whether the universe includes all ships potentially less than 79 feet in length or only those presumed to be less than 79 feet when excluding a certain number of vessels with length reported as zero or null.

[28] This is based on a 7 percent discount rate and 30-year life.

Table 5-3: Incremental Compliance Cost for New Diesel Vessels to Install a Fuel Air Separator System.

Type of Vessel	Vessel Size Category	Number of New Vessels per Year	Unit Cost	Total Cost	Annualized cost[a]
New diesel commercial fishing vessels	Less than 26 feet	254	$50	$12,710	$1,024
	26-50 feet	1,619	$490	$793,381	$63,936
	50 feet or greater	366	$930	$340,308	$27,424
	Sub-Total	*2,239*		*$1,146,399*	*$92,384*
	Less than 26 feet	256	$50	$1,146,399	$92,384
	26-50 feet	1,632	$490	$12,811	$1,032
	50 feet or greater	369	$930	$799,699	$64,445
	Sub-Total	*2,257*		*$1,155,529*	*$93,120*
New diesel other non-recreational vessels	Less than 26 feet	260	$50	$343,018	$27,643
	26-50 feet	676	$490	$1,155,529	$93,120
	50 feet or greater	361	$930	$12,986	$1,046
	Sub-Total	*1,297*		*$1,155,529*	*$93,120*
	Less than 26 feet	366	$50	$331,316	$26,700
	26-50 feet	953	$490	$336,122	$27,087
	50 feet or greater	509	$930	$680,423	$54,833
	Sub-Total	*1,828*		*$958,742*	*$77,262*
Total (lower-upper bound estimate)		**3,537-4,085**	**--**	**$1,826,822 - $2,114,271**	**$147,217-$170,381**

Source: Estimates for unit cost taken from Boatstore.com; West Marine Supply store; Boater's World and PBS Boat Store

[a]. Costs annualized over 30 years at a 7% discount rate.

Absorbent Material

EPA assumes that existing vessels are not currently equipped with a fuel-air separator or similar device to prevent spills during fueling; the sVGP will not require that existing vessels install equipment; instead, owners of existing vessels may comply with permit requirements by using oil absorbent material during fueling to catch drips and prevent spills. A search of boating equipment suppliers found that retail costs for oil absorbent pads range between $0.15 to $0.48 per pad (Best Value Supply, Inc; Pacific Environmental; AbsorbentsOnline.com).. EPA assumes that all existing vessels, both diesel and gasoline-fueled, are assumed to use a pad each time they refuel (see *Table 5-4*).

Table 5-4: Unit Cost for Oil Absorbent Pads Used for Fuel Management

Application	Unit Cost (Lower bound estimate)	Unit Cost (Higher bound estimate)	Number of Pads	Range of Unit Costs (per fueling activity)
All Engine and Oil Control Activities	$0.15/pad	$0.48/pad	1	$0.15-$0.48

Source: U.S. EPA estimates. Cost obtained from Best Value Supply, Inc; Pacific Environmental; and AbsorbentsOnline.com.

The number of pads used each year will depend on fueling frequencies. EPA estimated average fueling frequency by combining data on the average fuel tank capacity of fishing vessels, the average fuel intensity of the U.S. fishing fleet (gallons of fuel used per ton of catch), the tons of catch per year, and the number of fishing vessels. A report on vessel traffic in the Cook Inlet, Alaska reported the median fuel tank capacities for fishing vessels based

on size (Cape International, Inc and Nuka Research and Planning, 2006). Overall, for the 558 fishing vessels less than 80 feet long, the median fuel capacity ranged between 30 and 1,200 gallons (with the lower end of this range for one vessel under 20 feet in length) (Cape International, Inc and Nuka Research and Planning, 2006). Generally, the authors conclude from the data that fishing vessels typically have a fuel capacity of about 300-1,000 gallons (Cape International, Inc and Nuka Research and Planning, 2006).

Kitts (2010) estimated that in 2007 otter trawling fishing vessels consumed 900 liters of fuel per metric ton of 'all species' catch, or 238 gallons per metric ton of catch. Tyedmers et al. (2005) estimated fuel intensity in the rage of 50 to 2,000 liters of fuel per metric ton of catch, depending on the species, which overlaps with Kitts' estimate. According to NMFS, in 2007, there were 4.2 million metric of commercial landings by U.S. fishermen (NOAA, 2008). Multiplying fuel intensity by the total catch suggests a total fuel consumption of 1 billion gallons of fuel for all vessels in the U.S. commercial fishing industry. According to the MISLE database, there are 69,944 fishing vessels (of any size) in the U.S, approximately 96 percent of which are less than 79 feet in length. The fuel consumption data are therefore expected to be reasonably representative of the vessels addressed by the sVGP. Dividing the total gallons of fuel by the total number of fishing vessels leads to an estimate average consumption of 14,266 gallons of fuel per vessel per year. Dividing this value by the estimated fuel tank capacity of fishing vessels (300 to 1,000 gallons) suggests that fishing vessel refuel anywhere from 14 to 48 times per year.

While refueling frequencies may differ for other vessel types, in the absence of similar data for other vessel types, EPA assumes that other non-recreational vessels refuel at the same frequency as commercial fishing vessels.

Table 5-5: Annual Incremental Cost for Oil Absorbent Material Used for Fuel Management

Application	Number of Vessels	Frequency per Year	Unit Cost (Lower / Upper Bound Estimate)	Total Cost Per Year
Low Refueling Frequency				
Use oil absorbent material to catch drips from vent overflow and intake	110,421	14	$0.15	$231,884
			$0.48	$742,029
	128,644	14	$0.15	$270,152
			$0.48	$864,488
High Refueling Frequency				
Use oil absorbent material to catch drips from vent overflow and intake	110,421	48	$0.15	$795,031
			$0.48	$2,544,100
	128,644	48	$0.15	$926,237
			$0.48	$2,963,958
Range of Estimates	--	--		**$231,884-$2,963,958**

Source: Kitts, 2010; Tyedmers et al. 2005; NOAA, 2008; Cape International, Inc and Nuka Research and Planning, LLC, 2006; MISLE, 2010

The cost for using absorbent materials during refueling varies from approximately $232,000 to almost $3 million dollars, depending on the assumed unit cost value and frequency and reflecting the range in the population of vessels estimated to implement the practice (see *Table 5-5*). The incremental cost may be overestimated to the degree that vessel operators already use absorbent pads to catch spills and drips.

As discussed at the start of this section, EPA assumes that vessels already perform all other requirements listed under the fuel management category. For example, EPA assumes that operators routinely inspect fuel and

hydraulic system for damage or leaks and prevent overfilling fuel tanks. EPA further assumes that operators examine the surrounding water for presence of visible sheen and suspend fueling if a visible sheen is detected.

Therefore, aside from the incremental costs for oil absorbent material and fuel-air separator systems, no other requirements within the fuel management category are believed to impose a non-negligible incremental cost on vessel owners. *Table 5-6* summarizes the total incremental costs associated with this discharge category.

Table 5-6: Summary of Annual Costs for Fuel Management.

Practice	Total Annual Costs (Lower Bound)	Total Annual Costs (Higher Bound)
Oil absorbent material for existing commercial vessels	$231,884	$2,963,958
Fuel air separator system for new diesel commercial fishing vessels	$92,384	$93,120
Fuel air separator systems for new diesel other non-recreational vessels	$54,833	$77,262
Total Fuel Management Costs	**$379,101**	**$3,134,339**

5.2.3 ENGINE AND OIL CONTROL

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

(a) Periodically inspect the engine for any loose or leaking hoses, gaskets, and/or seals and if needed, repair or replace damaged parts as soon as possible.

(b) Place oil absorbent material or other spill response equipment under the vessel engine or use other preventative practices to minimize oil entering the bilgewater.

(c) Any spill or overflow of oil or other engine fluids must be cleaned up immediately. A supply of absorbent pads, pillows, or other materials should be kept onboard as appropriate for use in addressing or remediating any such spills or overflows, and supplies should be checked quarterly and restocked as necessary.

(d) Dispose of used oil-absorbent materials onshore in containers designed for oily waste disposal.

(e) If the vessel has a bilge oily water separator, periodically check for the presence of a visible sheen in surrounding waters while discharging.

-- If a visible sheen is observed as a result of this discharge, suspend discharge until the problem is corrected and clean up immediately.

(f) If you do not use a U.S. Coast Guard type-approved bilge oily water separator, use an oil-absorbent material to remove any oil from the bilge before discharging.

(g) Any discharge of packing gland or stuffing box effluent must not contain oil, including oily materials, in quantities that may be harmful. These discharges must not produce a visible sheen of oil or oily materials.

-- If accessible, segregated water which contains drips from packing gland effluent or stuffing box effluent must be checked daily for the presence of a visible sheen, while the vessel is operational and manned. If not accessible while the vessel is operational and manned, then the surrounding water must be checked for the presence of a visible sheen (while operating). If a visible sheen is observed, appropriate measures such as

the use of oil absorbent materials must be used to remove the presence of oil before the effluent may be discharged. Dispersants or emulsifiers that remove the appearance of a visible sheen must not be used.

-- If a visible sheen is observed in surrounding waters as a result of this discharge, suspend the discharge until the problem is corrected and clean up immediately.

(h) Unless technically infeasible, you must use environmentally acceptable lubricants (as defined in Part 6 of this permit) in all machinery and equipment, including but not limited to stern tubes, wires, and two-stroke engines, where discharges of oil to surrounding waters are likely to occur.

(i) Unless infeasible, prior to pumping the bilge, inspect the bilgewater for an oily sheen. While pumping the bilge, examine the surrounding water for the presence of a visible sheen.

-- If a visible sheen is observed as a result of this bilge pumping, suspend the discharge until the problem is corrected and clean up immediately.

(j) Dispersants, detergents, emulsifiers, chemicals or other substances that remove the appearance of a visible sheen may not be added to the bilge.

While many of the requirements listed in this category overlap with existing regulations, vessel operators could incur some incremental cost as a result of purchasing, utilizing, and disposing of oil absorbent pads and utilizing environmentally acceptable lubricants. All other requirements under this section of the sVGP are assumed to be performed as part of current operational practices, have negligible incremental costs, or overlap with existing requirements under 40 CFR 110 which prohibits the discharge of oil or oily residue into water.

For example, as part of general overall operation and ongoing maintenance of vessels, operators are assumed to inspect engines for loose or leaking hoses, gaskets, and seals and replace as necessary, and thus this requirement is assumed to have zero incremental cost. Additionally, many of the other oil discharge prohibitions emphasized in the sVGP are already required under 40 CFR 110. Under 40 CFR 110, vessels may not discharge any oil that will be harmful or cause a visible sheen or use dispersants or emulsifiers to remove sheen. 40 CFR 110 covers all requirements for bilge water and packing gland or stuffing box effluents and any discharge from an oil water separator. All vessel operators are assumed to already comply with the requirements to prevent any harmful oily discharge that may leave a visible sheen and thus there is zero incremental cost for re-emphasizing these requirements as part of the sVGP.

The sections below discuss more specifically the potential implications of requirements related to the use of absorbent material and environmentally acceptable lubricants.

AFFECTED VESSEL POPULATION

Based on the general nature of practices within this discharge category, EPA estimated that general requirements are potentially applicable to the entire universe of vessels potentially subject to the sVGP, i.e., about 115,000 to 138,000 vessels.

Table 5-7: Vessel Counts for Oil Pad Requirements for Engine and Oil Control.

Vessel Class	Total Vessel Count (Lower Bound Estimate)	Total Vessel Count (Upper Bound Estimate)
Commercial Fishing Services	67,178	67,713
Freight Barges	4,288	8,016
Freight Ships	579	768
Passenger Vessels	18,660	20,953
Public Vessels, Unclassified	67	622
Tank Barges	287	923
Tank Ships	49	179
Utility Vessels	8,876	11,034
Unspecified	15,012	27,375
TOTAL	**114,996**	**137,583**

COST ESTIMATES

Oil Absorbent Material

Based on data collected from boating equipment retailers, EPA estimates that the cost for oil absorbent material ranges between $0.31 per pad to $8.96 per sock (Best Value Supply, Inc; Absorbent Specialty Products; AmericanMarineSupply.com; Pacific Environmental; AbsorbentsOnline.com). Information provided by BoatUS on practices followed by recreational boaters suggests that boaters will generally put an absorbent sock in their bilge at the start of the season and that the sock lasts the entire season. While no specific information could be found for the vessels covered by the sVGP, given similarity in the application but potentially higher utilization rates for these vessels, EPA assumes that non-recreational vessels may use two socks or 50 pads per year for all these three practices combined (minimizing oil entry to the bilge, accidental spills, and removing oil from the bilge). Note that this is assumed to be distinct from pads used to clean spills during refueling.

EPA assumes that all covered vessels will be required to comply with these requirements, although this may be overestimating the incremental cost for the sVGP since the permit requirement does not contain a uniquely new practice and many operators already utilize oil absorbent pads. The estimates are therefore assumed to be rather conservative.

Table 5-8: Unit Cost for Oil Absorbent Pads and Socks for Engine and Oil Control

Type of Vessel	Unit Cost (Lower bound)	Number of Pads Per Year	Unit Cost (Upper bound)	Number of Socks Per Year	Range of Unit Costs
All Engine and Oil Control Activities	$0.31/pad	50 pads	$8.96/sock	2	$15.50-$17.92

Source: EPA estimates

Table 5-9: Annual Cost for Engine and Oil Control

Practice [1]	Number of Vessels	Unit Cost	Total Cost Per Year
Oil control using pads	114,996	$15.50	$1,782,438
	137,583		$2,132,537
Oil control using socks	114,996	$17.92	$2,060,728
	137,583		$2,465,487
Range of Estimates			**$1,782,438 - $2,465,487**

Source: EPA estimates.

[1] The two practices are not additive.

Lubricants

Vessel operators could also incur incremental cost as a result of the requirement to utilize environmentally preferred lubricants in all machinery and equipment where discharges to surrounding waters are likely to occur. EPA reviewed publicly available cost data for a variety of lubricants marketed for marine applications to determine whether lubricants classified as environmentally safer and biodegradable are more expensive than conventional formulas. EPA found significant variability in the cost of the two categories of lubricants, with the most notable differences being for lubricants targeted at very specific applications (e.g., dry lubricants and gear oils as compared to generic engine oils). Four different categories of lubricants were reviewed: lower gear (gear case) lubricant; dry lubricant; engine oil; and general application lubricant (penetrant, multi-purpose lubricant). EPA obtained cost data from retailers of marine lubricants for over 50 products classified across the four categories, with at least one product in each category being advertised as biodegradable or environmentally safe. Whether the environmentally safer products were more expensive than conventional products depended on the type of lubricant; environmentally preferred dry lubricants and gear oils were 54 and 32 percent more expensive than their counterpart, respectively, but engine oils and lubricants for general application were less expensive (by 28 and 24 percent, respectively). Whether the requirement imposes an incremental cost on vessel owners, therefore, will depend on the relative quantities of different types of lubricants used on vessels. Although EPA contacted boat repair shops to get insight on the amounts of lubricants commonly consumed by different types of vessels, these data were not readily available. As a rough estimate of quantities, EPA used the common package sizes as a proxy for the amount that may be purchased at retail by a vessel owner and assumed that vessel owners would make such purchases twice in any given year. While admittedly crude, this approach assumes that lubricant manufacturers package their products in quantities roughly equivalent to a single use.

EPA further assumes that all vessels will incur this cost, though this may overestimate the total costs, because non-self-propelled vessels may use less lubricant (no engine and fewer moving parts) and some vessel owners already use environmentally preferred lubricants; manufacturer information suggests that conventional lubricants still account for the bulk of the lubricants produced and sold, however, and the number of vessel owners that use only environmentally preferred lubricants may be relatively small.

Table 5-10: Incremental Cost for Environmentally Acceptable Lubricants.

Type of Lubricant	Vessels	Incremental Unit Cost [a]	Amount Per Year	Total Cost Per Year
Lower gear		$0.16/oz.	64 ounces	
Dry lubricant		$0.52/oz.	22 ounces	
Engine oil		-$0.07/oz.	128 ounces	
General application		-$0.23/oz.	48 ounces	
Total	114,996 - 137,583		1.68/year	$193,193 - $231,139

Source: Estimates for unit cost developed based on data from boating equipment retailers, West Marine, Jamestown Distributors, Amazon.com, and GreenBoatStuff.com.

A Negative values represent average cost savings for biodegradable products as compared to conventional lubricants

Table 5-11 summarizes the total costs for engine and oil control practices.

Table 5-11: Summary of Annual Costs for Engine and Oil Control.

Practice	Total Cost Per Year (Lower Bound Estimate)	Total Cost Per Year (Upper Bound Estimate)
Oil control practices	$1,782,438	$2,465,487
Use environmentally acceptable lubricant	$193,193	$231,139
Total Engine and Oil Control	**$1,975,631**	**$2,696,627**

5.2.4 SOLID AND LIQUID WASTE MANAGEMENT

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

> *(a) Prevent trash or garbage, including food waste, cigarette butts, bottles, and caps from entering any waste stream covered by this permit. This can be accomplished in part, by maintaining a tidy deck.*
>
> *(b) All vessels must have appropriate receptacles for retaining trash or garbage onboard the vessel. Examples of appropriate receptacles include secured trash bags or coolers, bins, or trash cans with secure lids. Store any used antifreeze, paint, out-of-date flares, or other toxics in secure containers and dispose of them properly at onshore disposal facilities.*
>
> *(c) Secure or otherwise prevent loose items on deck from entering any waste stream covered by this permit.*
>
> *(d) Prevent monofilament line, fishing nets, lines, lures, rope, bait boxes, and hooks from entering any waste stream covered by this permit.*

EPA expects that vessel owners already implement operating practices that comply with most of the requirements or that doing so involves no significant incremental change in existing operations. Thus, EPA assumes that vessel operators currently prevent trash, fishing equipment (lines, nets, lures, rope, hooks, etc.) and loose items on deck from being discharged into water. The only potential exception may be the need to procure a container to contain trash and other debris. While the requirement does not specify the design or size of the container, some vessel owners may not have an existing receptacle with a secure lid. The potential implications of this requirement are discussed below.

AFFECTED VESSEL POPULATION

Based on the general nature of practices within this discharge category, EPA estimated that general requirements are potentially applicable to all 115,000 to 138,000 non-recreational vessels less than 79 feet.[29]

COST ESTIMATES

EPA assumes that all commercial fishing vessels and small non-recreational vessels would have to procure a receptacle for trash, which can include a secured bag, cooler, bin or trash cans with secure lids. This analysis assumes that because EPA does not require the container to follow a specific design. Many vessels will therefore already have suitable trash receptacles or may have other receptacles that can be repurposed to this fulfill this requirement. As a conservative estimate, EPA assumes that up to 10 percent of vessel owners will need to purchase a new container. EPA obtained purchase costs for various sizes of outdoor trash cans. The price from online retailers (Amazon.com, Sears, and Home Depot) ranged from $12.98 for a 20-gallon plastic can, to $65.59 for a 44-gallon outdoor plastic can.

Table 5-12. Cost for Trash Receptacle.

Requirement	Number of Vessels	Unit Cost	Number Required	Total Annualized Cost Per Year[a]
Purchase trash receptacle	11,500	$12.98	1	$21,252
	13,758			$25,426
	11,500	$65.59	1	$107,389
	13,758			$128,482
Estimated Range				**$21,252 – $128,482**

Source: Cost for trash receptacle estimated from online retailers including Amazon.com, Sears, and Home Depot.

a. Cost annualized over 10 year assumed life for the container, using a 7% discount rate.

As discussed as the start of this section, EPA assumes that the other three solid and liquid waste management Permit requirements are performed as part of general operating practices and therefore vessel operators will incur no incremental cost to comply with these other requirements. The total cost for solid and liquid waste management, then, is the cost to certain vessel owners to purchase an appropriate trash receptacle. This cost ranges from approximately $21,200 to $128,500 (annualized).

5.2.5 DISCHARGES OF DECK WASHDOWN AND RUNOFF AND ABOVE WATER LINE HULL CLEANING

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

[29] Although the requirement regarding fishing lines and nets is assumed to only affect the roughly 68,000 commercial fishing vessels, as discussed at the start of the section, EPA does not anticipate that the requirement will impose significant changes beyond current practices

(a) Use all soaps and cleaners as directed by the label.

(b) Any soaps, detergents, or cleaners used on the vessel must be non-toxic, phosphate-free, and biodegradable. The use of soaps that are labeled toxic or highly toxic is prohibited under this permit.

(c) Prevent the introduction of on-deck debris, garbage, residue, and spills into deck washdown and runoff discharges.

(d) Minimize the discharge of paint chips and residue, especially during cleaning, maintenance, paint application, and reapplication. When performing these activities, collect and then dispose of chips and residues onshore in accordance with applicable requirements for the facility where operations are performed.

Based on review of public comment documents from the June 2007 EPA information request and information compiled for the VGP Economic Analysis (EPA, 2008a), large vessels already generally implement several of the practices listed under this discharge category.[30] It is unknown whether this is also the case of vessels less than 79 feet.

Therefore, EPA conservatively assumes that the requirement to use non-toxic and phosphate-free cleaners has the potential to impose incremental costs on vessel owners, to the extent that these products may be more expensive than the conventional cleaners and vessel owners do not already use these products as part of their current practices. Similarly, EPA reviewed information available on the current maintenance practices for smaller vessels to assess whether the requirement to minimize the discharge of paint chips and residue has the potential to impose incremental costs. The implications of these two requirements are discussed below.

AFFECTED VESSEL POPULATION

Based on the description of practices within this discharge category, deck washdown and runoff is potentially applicable to all 114,996 to 137,583 vessels. The population potentially affected by BMPs applicable to the deck runoff discharge category is shown *in Table 5-13*.

[30] The American Waterways Operators, an industry organization representing barges and towing vessels, provided information regarding vessel practices in their public comments for the 2008 VGP. All their member tank barges currently use drip pans on machinery, and all perform drip pan cleaning and/or draining. Furthermore, towing vessels currently clear decks of debris, garbage, residue, and spills before conducting deck washdowns, and all currently use environmentally friendly cleaners. Additionally, based on preliminary responses from industry representatives, most deck runoff BMPs are already practiced by other vessels: (1) deck cleanup is currently performed prior to deck washdowns, and (2) passenger vessels are assumed to practice deck cleanup prior to departing from port. However, most towing vessel/barge companies responded that it is not as common to perform deck cleanup prior to departing from port.

Table 5-13: Vessel Counts for BMPs Applicable to Deck Runoff.

Vessel Class	Number of Vessels (Lower Bound Estimate)	Number of Vessels (Upper Bound Estimate)
Commercial Fishing Services	67,178	67,713
Freight Barges	4,288	8,016
Freight Ships	579	768
Passenger Vessels	18,660	20,953
Public Vessels, Unclassified	67	622
Tank Barges	287	923
Tank Ships	49	179
Utility Vessels	8,876	11,034
Unspecified	15,012	27,375
TOTAL	**114,996**	**137,583**

COST ESTIMATES

EPA assumes that vessel operators already use soaps and cleaners as directed as a normal practice. Similarly, EPA assumes that vessel operators minimize the introduction into water of on-deck debris, garbage, residue, and spill as part of their normal boating practices. Therefore, there will not be any costs associated with these activities.

Although vessels are not currently required to utilize biodegradable, phosphate-free soaps, as discussed in *Section 5.2.1*, a comparison of the cost of different cleaners marketed to the boating community indicates that biodegradable, phosphate-free soaps are not necessarily higher (and are often cheaper) than conventional products. There should therefore be no incremental costs associated with the purchase of these products to comply with the sVGP requirements.

EPA assumes that vessel operators already minimize the discharge of paint chips and residue as a standard practice. When these activities are performed in the water, industry best practices described in EPA (2008a) suggest that efforts are already made to minimize discharges. When performed on-shore, it is unlikely that minimizing discharge will require any additional effort on the part of vessel owners.

5.2.6 VESSEL HULL MAINTENANCE

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

> *(a) If the vessel is equipped with an anti-foulant system, you must minimize the impact of that system or the discharges resulting from anti-foulant paints on the aquatic environment.*
>
> *-- You should consider whether the use of non-copper based paints adequately meets your anti-foulant needs and use less toxic alternatives to the extent practicable and available.*
>
> *-- Where drying or hull cleaning at haul-out is adequate for managing fouling (e.g., for vessels that are hauled frequently or for over-winter storage), do not use anti-fouling coatings if not needed.*
>
> *Discharges of tributyltin (TBT) are prohibited (zero-discharge standard). Two potential ways to meet this standard are to:*
>
> *-- Have no TBT coatings; or*

-- Have an effective overcoating that completely eliminates TBT discharges.

(b) Do not clean anti-foulant paint which releases biocides for the first 90 days after application.

(c) If the anti-foulant paint requires cleaning, gently clean hulls on a regular basis (this minimizes the need for stronger cleaners and more abrasive brushes).

(d) When cleaning hulls coated with anti-fouling paint while the vessel is in the water, use only soft sponges. You must examine the water while cleaning to assure that you are not causing a plume of paint to form. Stop immediately if any visible plume of paint appears in the water. Consider hiring a qualified, professional hull cleaner to do the work, and ensure that they follow environmental guidelines.

(e) When cleaning hulls coated with anti-fouling paint while the vessel is out of the water, always work away from the water in a location where paint chips and dust will not be washed into the water. Place a tarp under the area to catch loose particles, and properly dispose of paint chips, dust, and other particles. If you are working in an area that is covered by an NPDES permit (e.g. marina or drydock), you must follow the cleaning requirements of that permit.

(f) Vessel hulls must be periodically inspected, and if necessary, cleaned to prevent the spread or dispersal of potentially invasive species.

(g) Minimize the transport of any visible living aquatic organisms from one waterbody to another by regularly cleaning and maintaining the hull.

(h) Prior to transporting the vessel from one waterbody to another overland, you must inspect the visible areas of the vessel for any attached or visible stowaway living organisms. If organisms are found, they must be removed and appropriately discarded onshore. Removed organisms may not be discharged into waters subject to this permit.

EPA assumes that vessel owners using anti-foulant systems already make reasonable efforts to reduce the impact of the system or related discharges from anti-fouling paints as part of normal operating procedures. Therefore, this requirement has no associated incremental cost.

Due to the requirements of the Global Anti-fouling System Treaty, which took effect in 2008, TBT-based coatings are banned in most countries, and few if any vessels are still using TBT coatings. The corresponding sVGP requirements are therefore assumed to impose no incremental cost.

The implications of other substantive requirements specified for this discharge category are discussed below.

AFFECTED VESSEL POPULATION

Based on the general nature of practices within this discharge category, EPA estimated that general requirements are potentially applicable to about 115,000 to 138,000 vessels, as shown in *Table 5-14*.

Requirements applicable to vessels transported overland are assumed to affect only to a subset of vessels that are trailered from one waterbody to another. Since data are not available on the number of vessels that are trailered, EPA conservatively assumed that all vessels in the lower size category (less than 26 feet) have the potential to be trailered.

Table 5-14: Vessel Counts for BMPs Applicable to Vessel Hull Maintenance.

Vessel Class	Total Vessel Count (Lower Bound Estimate)	Total Vessel Count (Upper Bound Estimate)	Trailered Vessel Count (Lower Bound Estimate)	Trailered Vessel Count (Upper Bound Estimate)
Commercial Fishing Services	67,178	67,713	7,626	7,687
Freight Barges	4,288	8,016	53	99
Freight Ships	579	768	34	45
Passenger Vessels	18,660	20,953	1,761	1,978
Public Vessels, Unclassified	67	622	10	94
Tank Barges	287	923	39	126
Tank Ships	49	179	2	7
Utility Vessels	8,876	11,034	767	954
Unspecified	15,012	27,375	5,859	10,685
TOTAL	114,996	137,583	16,152	21,674

COST ESTIMATES

The requirement to not clean anti-fouling paint within 90 days of application will not result in any incremental costs, because this is currently considered a best practice for vessel owners (for example, the Clean Marinas Program guidelines already recommend against cleaning anti-fouling paints within 90 days of application), and it does not require any additional effort for vessel owners.

Likewise, requirements to clean hulls regularly are assumed not to result in incremental costs, as vessel owners are likely to perform regular cleanings as part of standard operating procedures. The recommendation to consider hiring a qualified hull cleaner to clean the vessel in the water is not a mandatory requirement and therefore will not result in incremental costs. Additionally, some marinas and harbors discourage the practice or already specify precautionary measures to be taken during the cleaning such that a qualified hull cleaner can more readily implement those precautions.

Based on information collected by EPA as part of the analysis of the VGP (EPA, 2008), the use of soft sponges to clean hulls with anti-fouling paint is already standard practice (in accordance with guidance provided by numerous marinas and harbors). This is because more aggressive cleaning could damage the anti-fouling paint or shorten its life. Therefore, EPA expects that there will be no incremental costs associated with this activity.

The review of the various requirements leaves two practices with the potential to impose incremental costs on vessel owners: use of a tarp to collect debris and hull inspections.

EPA assumes that the requirement to utilize a tarp to collect paint chips and dust when cleaning hulls with toxic anti-fouling paint could require vessel owners to purchase a tarp to collect the paint chips. While the frequency with which inspections to ensure that vessel hulls do not carry invasive species may need to be conducted would depend where vessels operate and travel to and whether the vessel is trailered over land to another waterbody, for the purpose of the analysis, EPA assumed that these inspections may be conducted on average four times a year. EPA separates out the cost for fishing vessels and other commercial vessels to perform these inspections, because the average labor rate for an employee on a fishing vessel is lower than in other industries. The costs of the two practices are summarized in in *Table 5-15*.

Table 5-15: Total and Annual Costs for BMPs Associated with Vessel Hull Maintenance.

Activity	Labor Hours	Unit Cost	Frequency	Number of Vessels (Upper/Lower Bound)	Total Annualized Cost per Year[a]
Purchase a tarp to collect paint chips when cleaning hulls with toxic anti-fouling paint out of the water	N/A	$0.96-$2.27[b]	1	114,996	$110,396 - $261,041
		$0.96-$2.27[b]	1	137,583	$132,080 - $312,313
Perform inspection to prevent spread of invasive species – non fishing vessel	0.5	$8.82[c]	4 times per year[d]	8,526	$1,503,981
				13,988	$2,467,443
Perform inspection to prevent spread of invasive species -- fishing vessel	0.5	$6.71[e]	4 times per year[d]	7,626	$1,023,406
				7,687	$1,031,556
Total estimate range for vessel hull maintenance	- -	--	--		**$2,637,783- $3,811,312**

a Cost annualized using a 7% discount rate for the private sector.

b Unit Cost is estimated based on estimates from a Florida wholesaler (dpciwholesale.com) and Amazon.com for blue tarps. Low is a 15x15 blue tarp from the wholesaler. High is a 12x16 dry top blue tarp from Amazon. Value is annualized based on assumed life of 10 years and 7 percent discount rate.

c Unit cost is estimated by multiplying the labor hours by the average hourly labor rate of $16.53 for deck washdown given in the EA for the Final VGP, updated to 2010$ ($17.64) using the Employment Cost Index. Inspections are by the vessel crew.

d Inspections are assumed to be performed on average 4 times per year.

e Unit cost for fishing vessels is estimated by multiplying the labor hours by the mean hourly labor rate of $13.41 ($2010) from BLS Occupational and Employment Statistics for code 45-3011 “Fishers and Related Fishing Workers.”

The total per year cost of vessel hull maintenance activities ranges between $2.6 million and $3.8 million, depending on the vessels included in the universe and the low and high unit cost. The annualized cost of the tarp is approximately 300,000 per year, and thus the vast majority of the cost stems from inspections to prevent the spread of invasive species for vessels that move overland.

5.2.7 GRAYWATER

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

(a) Minimize graywater discharges in areas that have heavy vessel traffic or heavy recreational use and in marine sanctuaries, national wildlife refuges, national wild and scenic rivers, and national wilderness areas. If the vessel has the capacity to store graywater in these waters, it should be stored and later discharged in other waters or onshore.

(b) Minimize the production of graywater while the vessel is stationary in confined waters (e.g., marinas, harbors). If the vessel has the capacity to store graywater, it should be stored and discharged at an appropriately equipped onshore facility or discharged while the vessel is underway.

(c) You must use soaps, detergents and cleaners that are phosphate free, non-toxic, and biodegradable for any activities that may result in their introduction into graywater. Excess oils, including animal fats and

vegetable oils, used during cooking must not be added to the graywater system or into any other discharge covered by this permit.

AFFECTED VESSEL POPULATION

Based on the description of practices within this discharge category, graywater discharges are applicable to every vessel class except for barges. However, there is some overlap with the Clean Water Act's existing provisions and with 33 CFR159.309, as well as overlap regarding the number of vessels that currently practice specific BMPs. The American Waterways Operators, within the public comments, stated that all towing vessels currently use environmentally friendly detergents.

The population potentially affected by BMPs applicable to the graywater discharge category is shown in *Table 5-16*. The number of vessels excludes those not anticipated to have discharge graywater.

Table 5-16: Vessel Counts for Graywater BMPs.

Vessel Class	Total Vessel Count (Lower Bound Estimate)	Total Vessel Count (Upper Bound Estimate)
Commercial Fishing Services	67,178	67,713
Freight Ships	579	768
Passenger Vessels	18,660	20,953
Public Vessels, Unclassified	67	622
Tank Ships	49	179
Utility Vessels	8,876	11,034
Unspecified	15,012	27,375
TOTAL	110,421	128,644

COST ESTIMATES

Based upon research presented in the economic analysis of the 2008 VGP (EPA, 2008), practices associated with minimizing graywater production are not anticipated to impose incremental costs on vessel owners. The majority of vessels (excluding passenger vessels) produce little to no graywater, and most that do produce graywater do not have the ability to store it. For those that do, it is current practice to discharge onshore at appropriate facilities.

Furthermore, as described in *Section 5.2.1*, EPA's review of the retail cost of available cleaning and detergent products suggests that phosphate-free detergents are not more expansive than alternative products that contain phosphate. Consequently, the requirement to use only phosphate-free detergents is not expected to impose an incremental cost on vessel owners

5.2.8 FISH HOLDS

PERMIT REQUIREMENTS

Requirements pertaining to this category include:

(a) If you are unloading your catch at a shore-based seafood processor or other pier and a shore-based discharge facility is available and economically achievable, you must discharge your effluent (including dirty ice) to that shore-based facility instead of discharging to surrounding waters.

(b) Do not discard any unused bait overboard, unless you caught that bait in that waterbody or watershed. Unused bait purchased from a bait shop or dealer may not be discharged overboard.

(c) Minimize the discharge of fish hold water or ice while in port. All reasonable steps must be taken to prevent the discharge of excess fish hold water and ice while the vessel is stationary at the pier. If solid fish waste is contained in the fish hold effluent, the fish hold effluent may not be discharged while in port, unless a physical separation method is used (e.g. filters or removal of residuals).

(d) When cleaning your fish hold, you must use non-toxic, phosphate-free, and biodegradable soaps and cleaners. Furthermore, while pierside and stationary, you may not wash any residual solids into surrounding waters.

AFFECTED VESSEL POPULATION

Based on the description of practices within this discharge category, fish hold permit requirements are potentially applicable to all commercial fishing vessels, with the exception of small troller and shrimper vessels which typically use coolers and to offload these coolers directly to shore.

MISLE data on the characteristics of commercial fishing vessels indicate that there are 172 shrimpers and 258 trollers less than 26 feet. Therefore, between 66,748 and 67,713 commercial fishing vessels are assumed to have fish holds.

COST ESTIMATES

The proposed sVGP requires that vessel operators use a physical separation method to remove excess fish waste and residuals from the water. Codex Alimentarius provides a recommended International Code of Practice for Fresh Fish with technological guidelines for the handling and processing of fresh fish intended for human consumption (FAO, 1976). The Codex specifies that vessels should use coarse filters for their fish hold effluent. When present, these coarse filters should help ensure that no excess fish debris is discharged, consistent with the sVGP requirements.

According to a review of available information, two ports were identified which offer the option to discharge fish hold effluent to a shore-based facility instead of discharging to surrounding waters. These two ports are the Port of San Francisco, CA and the Port of Sitka, AK. It is unclear whether either port passes on the cost of shore-based fish hold discharge treatment to vessel operators as part of their docking fees, and if so, whether these costs may change if a larger number of vessels were to use the service.

EPA assumes there are no costs associated with not discarding any unused bait overboard, given that the vessel operators can readily wait and discard the bait at an appropriate shore-based facility.

5.2.9 BALLAST WATER

PERMIT REQUIREMENTS

Requirements pertaining to this category apply to ballast tank-equipped vessels with less than 8 cubic meters of ballast water capacity.[31] They include:

(a) Avoid the discharge or uptake of ballast water in areas within, or that may directly affect, marine sanctuaries, marine preserves, marine parks, shellfish beds, or coral reefs.

(b) Minimize or avoid uptake of ballast water in the following areas and situations:

-- Areas known to have infestations or populations of harmful organisms and pathogens (e.g., toxic algal blooms).

-- Areas near sewage outfalls.

-- Areas near dredging operations.

-- Areas where tidal flushing is known to be poor or times when a tidal stream is known to be turbid.

-- In darkness, when bottom-dwelling organisms may rise up in the water column.

-- Where propellers may stir up the sediment.

-- Areas with pods of whales, convergence zones, and boundaries of major currents.

(c) If you discharge ballast water into waters covered by this permit, discharge only the minimal amount of ballast water essential for vessel operations.

(d) When feasible, use one of the following measures to reduce the potential for transfer or introduction of organisms to waters of the U.S.:

-- Use potable water for ballasting.

-- Utilize onshore treatment or disposal methods for ballast water.

-- For vessels that conduct fixed routes, capture and reuse ballast water in each port.

AFFECTED VESSEL POPULATION

Few vessels covered under the sVGP are believed to be affected by the requirements pertaining to ballast water discharge. As noted by the U.S. Coast, vessels less than 100 feet "typically operate in more sheltered environments and do not load and discharge ballast. Their stability characteristics generally accommodate the amount and type of cargo they carry, precluding the need to use ballast as a stability enhancer." (USCG, 2008) Further, several types of vessels (e.g., towing vessels, crew boats, passenger vessels) in the sVGP vessel population typically do not rely on ballast for stability.

[31] Vessels with 8 cubic meters or greater of ballast water capacity that discharge ballast water are not authorized to discharge under this permit, and must instead seek coverage under the VGP.

COST ESTIMATES

The proposed sVGP requires that vessel operators implement simple best management practices to minimize the potential harm posed by ballast water discharges. EPA believes that the practices are sensible ways to minimize the risk of invasions, while being flexible enough to impose no incremental costs on vessel owners.

5.3 PAPERWORK BURDEN AND MONITORING REQUIREMENTS

Recordkeeping, periodic inspections, and annual inspections are already required or performed as a matter of regular business for non-recreational vessels.[32] However, additional time for these tasks may be required to comply with certain requirements specific to the sVGP.

For recordkeeping, the sVGP introduces additional paperwork in the form of the Permit Authorization and Record of Inspection (PARI) form and the recording of the quarterly inspections. Based on the relatively simple form, EPA assumes that 0.5 hours will be required to comply with the sVGP paperwork burden per year.

To calculate the total annual cost per vessels, EPA used the average hourly labor rate provided by the industry survey responses performed for the VGP Economic Analysis, updated to 2010 dollars, or $33.72.[33] EPA assumes that all 115,000 to138,000 vessels will incur this 0.5 hour burden per year of compliance costs, regardless of their type, and that all vessels must perform these tasks each. The annual cost of these requirements is $16.86 per vessel.

Table 5-17 presents the total cost estimates for recordkeeping, and routine and annual inspections.

Table 5-17. Recordkeeping and Inspection Burden.

Requirements	Vessel Count	Burden Hours per Vessel per Year	Total Burden Hours	Hourly Rate[a]	Total Annual Cost
Lower bound estimate	114,996	0.5	57,498	$33.72	$1,938,833
Upper bound estimate	137,583	0.5	68,792	$33.72	$2,319,649

[a] Average labor rates for industry sectors with vessels covered by the sVGP, in 2010 dollars.

Each year, annual recordkeeping and inspection requirements will cost between $1.9 million to $2.3 million, depending on the number of vessels assumed to be covered by the sVGP.

[32] The sVGP requires that vessel owner conduct a visual inspection on a quarterly basis to ensure that areas are clear of garbage, exposed raw materials, oil, or any other materials that could be discharged into any waste stream or receiving waters and that there is no uncontrolled or unmanaged sources of these pollutants. EPA believes that these inspections are already being performed as a matter of regular business (and therefore no incremental cost will be incurred by vessel owners). The recording of the inspections in the PARI form, however, is accounted for in the burden estimated in this section.

[33] The hourly labor rate of $31.61 was updated to 2010 dollars using Employment Cost Index from the Bureau of Labor Statistiscs (BLS, 2011).

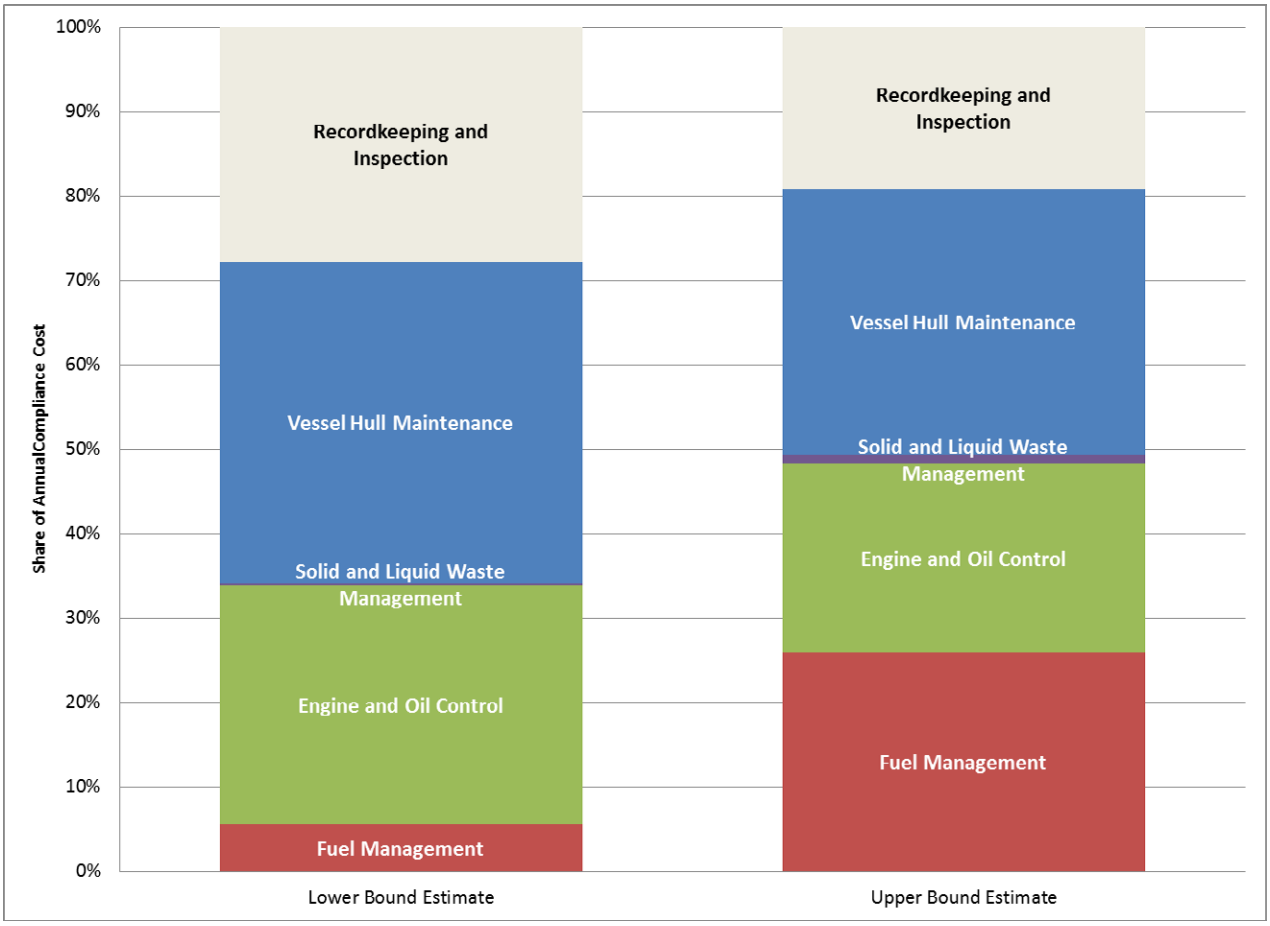
5.4 TOTAL NATIONAL COSTS

The estimated annual total compliance costs for all activities conducted under the proposed sVGP are provided in *Table 5-18*. The estimated sVGP compliance costs vary because of the different assumptions made regarding the number of vessels expected to be covered by the sVGP, the frequency with which incremental costs will be incurred by different vessels, and the unit costs for each activity or practice. The total incremental costs for each category of activities are presented for the overall set of vessels covered by the sVGP; as appropriate, the costs reflect the subset of vessels to which an activity is expected to apply (e.g., fish hold requirements only apply to commercial fishing vessels). As shown in the table, estimated total annual costs range between $7.0 million and $12.1 million per year. *Figure 5-1* illustrates the fraction of the estimate compliance costs represented by the different requirement categories. A significant share of total compliance costs is represented by vessel hull maintenance (about 35 percent of the total cost), with engine and oil control, and recordkeeping and inspection requirements, each accounting for about 25 percent of the remaining costs. Fuel management practices represent about a quarter of the total for the upper bound estimates, but only 5 percent of costs for the lower bound estimates.

Table 5-18: Total Annual Compliance Costs over the Five-Year of the sVGP (2010$).

Permitted Discharge Category	Total Annual Cost (Lower Bound Estimate)	Total Annual Cost (Upper Bound Estimate)
General Requirements	$0	$0
Fuel Management	$379,101	$3,134,339
Engine and Oil Control	$1,975,631	$2,696,627
Solid and Liquid Waste Management	$21,252	$128,482
Discharges of Deck Washdown and Runoff and Above Water Line Hull Cleaning	$0	$0
Vessel Hull Maintenance	$2,637,783	$3,811,312
Graywater	$0	$0
Fish Holds	$0	$0
Ballast Water	$0	$0
Recordkeeping and Inspection	$1,938,833	$2,319,649
Total Permit Costs	**$6,952,600**	**$12,090,410**

Figure 5-1: Share of Total Annual Compliance Cost (Lower/Upper Bound Estimate), by sVGP Requirement Category.



To calculate an average per vessel cost, EPA divided the low and high total annual compliance cost by the corresponding lower and upper bound estimates of the number of vessels covered by the sVGP. Costs for individual vessel are expected to vary depending on the vessel type and characteristics. For example, some vessels (e.g., barges), may not incur compliance costs for some requirements. A vessel owner that already implements practices to control discharges covered by the Permit only incurs the incremental cost associated with the paperwork burden. These requirements amount to approximately $17 per year. For other vessels, average incremental compliance costs range from $62 to $98 per year, per vessel.

5.5 ISSUES AND UNCERTAINTIES

There is considerable uncertainty regarding estimated compliance costs. Major areas of uncertainty relate to practices implemented in the baseline, variability in practice costs among vessels of different types and sizes, and variability in the frequency with which various practices will have to be conducted. These issues are discussed below.

- *Baseline level of implementation*. The relevant costs for the analyses are those that are imposed by compliance with the sVGP, beyond what vessel owners are already doing to comply with existing regulations and as part of their normal operations. To the degree that a practice is already being

conducted, compliance with the sVGP requirement would not impose an additional cost on the vessel owner. Little information is publicly available, however, to assess whether some of the practices for which EPA estimated a cost are already included under baseline conditions. In general, EPA conservatively assumed that all vessels would incur incremental costs. For several requirements, this assumption is believed to overstate the costs of the sVGP. For example, EPA assumed that vessels owners do not currently use absorbent material to catch drips and clean spills during fueling or absorb oil that accumulates in the bilge. However, absorbent material are widely available (in some cases they are distributed free of charge to boaters), and the oil spill prohibition in the Clean Water Act makes it likely that at least some vessel owners currently implement the practice. Given the magnitude of incremental costs associated with fuel management practices, if even a fraction of sVGP vessels do not incur incremental cost for this practice, the total costs of the Permit would be much lower.

- *Variability in cost for different vessel types and sizes*. The cost of some of the practices discussed in this section varies depending on the type of vessel, its size, and the type of service. For example, the cost of installing a fuel-air separator depends on the engine size and configuration, while the type of equipment present on a vessel may determine the type and quantity of lubricants used. Information available to EPA was not sufficiently detailed to develop cost estimates that would be sensitive to each of the possible cost factors. Consequently, EPA instead used ranges of costs that are aimed to illustrate the variability in costs among vessels addressed by the sVGP. Depending on the distribution of vessel types and sizes relative to the cost of the individual practices, the total costs of the sVGP may be closer to the either lower bound or upper bound estimates.
- *Practice frequency*. Cost estimates for several practices depend on the number of times a given vessel may need to implement the practice during each year of the Permit. As for the unit cost of the practice, the frequency of implementation is expected to potentially vary depending on the type of vessel, vessel size, area of operation, and other factors. For example, fueling frequency will determine the number of times a vessel owner may need to catch drips or clean spills; yet this frequency is a function of the vessel use, fuel tank volume, and numerous other factors for which there are no detailed information readily available. EPA developed reasonable ranges based on indirectly related data such as fuel efficiency statistics. These ranges may over/underestimate the frequency of practice implementation for different types of vessels, and depending on the distribution of these vessels among the population of vessels addressed by the sVGP, may over or underestimate the sVGP costs.

6 ANALYSIS OF IMPACTS ON FIRM REVENUES AND FINANCIAL PERFORMANCE

The previous chapters assessed total compliance costs to vessels covered in the sVGP. As summarized in *Section* 4, the majority of these vessels are associated with firms in the fishing and water transportation industries, and in the drilling oil and gas wells sector of the mining industry. *Section* 5 presents the ranges of compliance costs that may be incurred by each vessel covered by the sVGP, depending on the assumed unit costs of each required practice, which may vary by vessel type, size, and operating characteristics.

To determine the economic impacts of the sVGP, EPA must examine the incremental compliance costs relative to the financial conditions of "typical" businesses associated with the affected vessels. Since approximately 95 percent of the firms in the water transportation and the drilling oil and gas wells sector, and practically all firms associated with commercial fishing vessels, are small (see *Section 4.5.2: Small Businesses),* it is unlikely that a significant number of large firms would incur material impacts. Large firms are also more likely to operate larger vessels. In case where they also operate small vessels covered by the sVGP, large firms are likely to have revenue that are comparatively much greater than the compliance costs estimated in *Section* 5. Therefore, because the relative impact of sVGP compliance and the number of affected entities are expected to be much greater for small businesses, [34] the firm-level analysis focuses on assessing impacts on small businesses.

6.1 METHODOLOGY

The analysis involves combining the estimated incremental operating costs attributed to compliance with the sVGP with information about baseline financial conditions of model firms in each industry to examine the potential financial impacts on firms. Cost-to-revenue ratios are used as metrics for potential financial stress, where financial stress may reveal itself as a lack of profitability, cash deficiencies, or even bankruptcy. Firms expected to experience financial stress may need to change their business operations, including potentially downsizing or closing operations.

The key steps of the analysis involve: (1) assigning each vessel in the vessel database to a NAICS code, (2) estimating the number of vessels per firm in each industry, (3) estimating the distribution of compliance costs per vessel and per firm, and (4) comparing the costs to the firm revenues. These steps are described below.

6.1.1 ASSIGN EACH VESSEL TO A NAICS CODE

The framework for the model firms reflects the range of firm types across the major industry groups. Financial data for each major industry group are available in the Economic Census while SBA provides firm data by revenue bracket. Since the Economic Census does not provide data specific to individual vessels or firms necessary to estimating compliance costs, EPA used the data in MISLE (which contain more complete numbers of all potentially regulated vessels and firms) to identify the affected vessels and firms, and cross-referenced the vessel data to financial information from the Economic Census and other sources using NAICS industry categories.

[34] Small businesses are either: A small business according to SBA size standards; a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; or a small organization that is a not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

The number of firms likely to incur costs as a result of the Permit was identified using the MISLE data based on the number of uniquely named managing owners for vessels expected to be covered by the sVGP. The approach to assigning NAICS codes to each managing owner (which is generally assumed to be the relevant firm for this analysis), and for each vessel, was described earlier in *Section 4.2*.[35]

Once the number of firms with vessel permits was estimated for each NAICS code, EPA distributed these firms across revenue size categories proportionally to the distribution of firms by revenue size category indicated in Economic Census data. This estimated distribution of firms by revenue size category is assumed to be more accurate than estimates that could be derived solely from the Economic Census, since the Economic Census includes firms that are not expected to be covered by this Permit, such as firms that operate vessels 79 feet in length or larger, It also excludes nonemployers, which represent the vast majority of entities in the fishing industry.[36]

6.1.2 ESTIMATE THE NUMBER OF VESSELS PER FIRM

To establish the baseline and post-cost financials for each model firm, the per-vessel BMP costs developed from *Chapter 5* are applied at the firm level. To determine the total sVGP compliance costs that a firm could incur, EPA first estimated the average number of vessels owned and operated by firms in each NAICS sector using information from the MISLE database.

For each NAICS code, EPA determined the number of vessels that were listed with a firm name as well as the number of firms corresponding to these vessels. Based upon the total number of firms and vessels within the subset in each NAICS code, the average number of vessels per firm was determined for each NAICS code. This average number was estimated using MISLE data based on the number of vessels associated with each uniquely named managing owner. As shown in *Table 6-1*, the average number of vessels varies across the NAICS sectors from about one vessel per owner in the fishing industry, to nearly 4 vessels per owner in the support activities for water transportation sector.

[35] Of the total 138,000 vessels in the database that are estimated to be potentially subject to sVGP, 57,891 vessels could not be assigned a NAICS code.

[36] As discussed in *Section 4.3.3*, vessels less than 79 feet represent a relatively small share (4 to 39 percent, depending on the type of vessel) of vessels used for freight transportation.

Table 6-1: Number of Vessels by Firm in Each Industry Sector.

NAICS Description	Number of Vessels Associated to the Same Managing Owner		
	Minimum	Maximum	Average
Water Transportation Industry			
Deep Sea, Coastal, and Great Lakes Water Transportation	1	32	1.8
Inland Water Transportation	1	72	2.0
Scenic and Sightseeing Transportation, Water	1	24	1.3
Support Activities for Water Transportation	1	74	3.7
Fishing Industry			
Fishing[a]	1	96	1.1
Mining Industry			
Drilling oil & gas wells sector	1	34	3.1

Source: EPA analysis of MISLE data (USCG, 2009).

Since the number of vessels operated by a firm is expected to vary among the different firm sizes, EPA assumed that smaller firms (in revenue term) have fewer vessels than the larger firms. The firms in the smallest revenue category in each industry (e.g., firms in the water transportation industry with less than $50,000 in revenue) are assumed to operate a single vessel, with the number of vessels assumed to increase with revenue such that the average number of vessels across each industry matches the value indicated in *Table 6-1*.

6.1.3 ESTIMATE COMPLIANCE COSTS PER VESSEL

For each vessel type and practice, EPA already estimated in *Section 5:* (1) the total number of vessels, (2) the probability of a vessel incurring incremental costs, and (3) the incremental cost of each practice.

A detailed analysis of the cost impacts to each model firm would consider the probability that each of a firm's vessels incurs cost under each of the practices and would estimate the expected annual compliance cost for the firm based on this probability. To provide a first-order screening-level assessment of the cost impacts, and given the approximate compliance cost estimates developed in *Section 5*, which do not differentiate costs by vessel size or operational characteristics, however, EPA applied a simple approach that considers the potential impacts on firms assuming that all vessels are subject to costs at the extreme ends of the estimated range. Using this approach, the minimum and maximum costs per vessel are simply multiplied by the number of vessels per firm in each industry for a given revenue size category to estimate firm level costs (see *Section 6.1.2*). Accordingly, firms in the smallest revenue size category, which are assumed to operate a single vessel, are assumed to have firm-level compliance cost ranging from $17 to $98 per year, with the lower bound estimate representing vessels that already implement practices required by the sVGP and which therefore incur only the paperwork burden associated with the Permit.

6.1.4 COMPARE FIRM-LEVEL COSTS TO FIRM-LEVEL REVENUES

Data from the Economic Census as well as from the SBA's Statistics of U.S. Businesses were used to determine the firm-level financial data for the transportation and mining industries. These sources provided the distribution of firms across several revenue brackets as well as the average revenue value in each revenue bracket. For firms associated with commercial fishing vessels, EPA also used fisheries statistics from NOAA and other sources on revenue per vessel in different geographic regions (see *Section 4.5*) to characterize the distribution of revenue

among firms of different sizes. These other sources provide the revenue per vessel for different vessel characteristics (size, equipment) and types of fisheries.

To evaluate the potential impact of the sVGP on small entities, EPA used a cost-to-revenue test to evaluate the potential severity of economic impact on vessels and facilities owned by small entities. The test calculates annualized pre-tax compliance cost as a percentage of total revenues and uses a threshold of 1 and 3 percent to identify facilities that would be significantly impacted as a result of this Permit.

The cost values equivalent to the 1 and 3 percent thresholds were estimated from the average revenue in each revenue bracket, or the midpoint of the revenue bracket when average revenue was not reported. EPA estimated the percentage of firms that would be significantly impacted as a result of this Permit as the percentage of firm for which the estimated firm-level costs (number of vessels times the per vessel compliance costs) exceeded the 1 percent or 3 percent revenue thresholds.

6.2 RESULTS OF FIRM-LEVEL ANALYSIS

After calculating the distribution of per-firm costs, the number of firms where costs exceed 1 percent and 3 percent of revenue was estimated (by NAICS sector and revenue bracket). The costs used in the economic analysis are annualized costs, which reflect the annual equivalent value of first-year (one-time) costs and recurring costs.

Table 6-2 summarizes the average firm-level revenue, number of firms, and cost thresholds across industry sectors for the 1 percent and 3 percent cost-to-revenue tests. The cost thresholds indicate the compliance costs that would correspond to 1 percent and 3 percent of revenue, and yield a significant impact based on the cost-to-revenue test. Because the impact of sVGP compliance is likely to be most significant for firms at the lower end of the firm size spectrum, the table focuses on firms in the smallest revenue category in each industry. For the water transportation industry, this category includes firms earning less than $100,000 each year. For the fishing industry, this category includes all nonemployer establishments (which are assumed to be single-establishment and single-vessel firms).

Table 6-2: Estimated 1% and 3% Revenue Thresholds by NAICS Code for Firms in Smallest Revenue Category.

NAICS	Industry	Average Revenue of Firms in Category	Number of Firms in Revenue Category	Compliance Cost at 1% Revenue Threshold	Compliance Cost at 3% Revenue Threshold
Water Transportation					
483111	Deep sea freight transportation	$33,143	7	$331	$994
483112	Deep sea passenger transportation	$49,417	12	$494	$1,483
483113	Coastal/Great Lakes freight transportation	$56,765	17	$568	$1,703
483114	Coastal/Great Lakes passenger transportation	$53,154	13	$532	$1,595
483211	Inland waterways freight transportation and towing transportation	$35,200	15	$352	$1,056
483212	Inland waterways passenger transportation and other water transportation	[a] $50,000	34	$500	$1,500
487210	Scenic and sightseeing transportation, water	$48,283	247	$483	$1,448
488310	Port and harbor operations	$60,636	11	$606	$1,819
488320	Marine cargo handling	$68,000	11	$680	$2,040
488330	Navigational services to shipping and salvage	$55,661	56	$557	$1,670
488390	Other support activities for water transportation	$59,742	120	$597	$1,792
Fishing					
1141	Commercial fishing [b]	$44,866	65,237	$449	$1,346
Mining					
213111	Drilling oil and gas wells	$48,316	237	$483	$1,449

[a] No average revenue per firm is available. The value reflects the mid-point of the revenue size category.

[b] Data reflect nonemployer statistics.

As shown in the table, compliance cost thresholds range between $331 and $2,040 per year for the 1 percent and 3 percent levels, respectively, depending on the industry. The estimated sVGP compliance costs ($17 to $98 per year) are well below these thresholds. Based on the average characteristics of firms in the lowest revenue category, therefore, sVGP compliance costs are below the 1 percent and 3 percent cost-to-revenue thresholds.

6.3 BREAKOUT OF SMALL COMMERCIAL FISHING FIRMS

The use of average firm revenue in the screening-level analysis above masks the variability among the firms within a revenue size category. Nonemployer statistics for the fishing industry report average receipts of $44,866 for these establishments, which are assumed to correspond generally with the smallest category of firms, on a revenue basis. As described in the profile for the commercial fishing sector in *Section 4.5*, however, data from other sources suggest that within these small operators, annual revenue can vary depending on the catch, type of equipment used, and other operational characteristics.

For example, Northeast groundfish vessels have revenue averaging $16,509 for vessels less than 30 feet (NOAA, 2011b), while small vessels involved in the salmon and Dungeness crab fishery in California and Oregon have revenue of $25,031 (CADFG, 2008). Average revenues per vessel for slightly larger vessels are significantly higher: $128,907 for groundfish vessels in the 30 to 50-foot range, and $81,897 for medium and large salmon/crab vessels. As discussed in *Section 4.5*, revenue also varies within each vessel size class and across the overall vessel population. The average revenue among vessels in the lowest decile is $2,176 per year, and about 30% of vessels have average revenue less than $47,392.

Permit data for Alaska fisheries show similarly wide variability with reported average earnings per permit holder ranging from less than $2,000 for the lower quartile for halibut fishing by hand troll, to nearly $2.5 million for the upper quartile for king crab fishing. Within each type of fishery, the ratios of revenues earned by the top quartile permit holders and those earned by the bottom quartile permit holders can be as high as twenty to one. In general, larger vessels (60 feet or greater in length) have higher revenue than smaller vessels.

To assess the likelihood for the smallest of firms to have cost-to-revenue ratios exceeding the 1 percent and 3 percent thresholds, EPA tested alternative distributions of small firms according to imputed annual revenue derived from the performance statistics described above. This more detailed assessment focuses on firms in the fishing industry since it has by far the largest number of firms anticipated to be covered by the sVGP.

Using the average per vessel revenues reported by NOAA (2011) for the Northeast groundfishing fleet, EPA estimated the percentage of vessels for which per vessel compliance costs would exceed the 1 percent and 3 percent cost-to-revenue thresholds. Based on the revenue distribution provided in NOAA (2011) and described in *Section 4.5*, 81 and 144 commercial fishing vessels (10 percent and 17 percent of vessels) have costs that could exceed 1 percent of revenue when considering compliance costs of $17 and $98, respectively.

EPA did a similar analysis using commercial fishing statistics published by Alaska's Commercial Fisheries Entry Commission, which break out the average revenue by fishery (catch, equipment, and region) into permit quartiles. For the purpose of this analysis, EPA assumed that a single-vessel firm holds a single permit and that all vessels within a quartile have the same revenue as the average for the group (i.e., distribution follows a step function). *Table 6-3* summarizes the findings. According to the 2010 data, 1,678 permits out of the 11,822 permits active that year (14 percent) had average revenues that were below $9,800, the revenue level necessary for compliance costs of $98 to be below the 1 percent threshold. For an assumed compliance cost of $17, the percentage of permits with revenue below the 1 percent threshold is 2 percent.

Table 6-3: Statistics on the Number of Alaska Fishery Permits in Revenue Quartiles below Specified Values (Based on preliminary 2010 data from Alaska Commercial Fisheries Entry Commission (2011)).

Annual Compliance Cost	Cost-to-Revenue Test	Relevant Revenue Thresholds	Number of Permit Holders in Earnings Quartile Below Threshold	Percentage of Permits Below Treshold (11,822 Permits Total)[a]
$98	1%	$9,800	1,678	14%
$17	1%	$3,267	1,678	7%
$98	3%	$1,700	278	2%
$17	3%	$567	0	0%

Source: EPA analysis of Quartile Downloadable Data from State of Alaska, Commercial Fisheries Entry Commission (2011).

[a] Excludes permits for fisheries involving exclusively vessels larger than 79 feet and permits for clam harvest by shovel.

Similar to findings when using the distribution of revenues for Northeast groundfish vessels, therefore, the data for Alaska permit revenue suggests that even with relatively low compliance costs, some permit holders could still potentially incur costs that exceed the 1 percent of their revenue.

A closer look at the revenue data per vessel and per permit, however, suggest that these data may underestimate revenue for commercial fishing firms, and therefore overestimates the impacts of sVGP compliance on the commercial fishing sector. As discussed in *Section 4.5.2* and elsewhere in this report (see *Section* 2), a certain number of small vessels used in commercial fishing activities were likely manufactured as pleasure crafts and therefore would fall under the CBA definition of recreational vessels and would not be covered by the sVGP requirements. This is expected to affect more strongly the smaller vessels (e.g., less than 26 feet). Additionally,

per vessel or per permit revenue data suggest that commercial fishing may not be a primary economic activity for at least some permit holders, even when accounting for the seasonality of fisheries in the northeast and in Alaska. First, fuel costs alone are likely to be greater than $2,000 for any sustained vessel use. Second, and perhaps more significant, statistics on the revenue per trip for vessels less than 30 feet show average revenue of $384 and $734 for groundfish and non groundfish trips, respectively, with trips averaging 0.35 to 0.38 days each (NMFS, 2011). Even when accounting for potential variability in landed value at the end of each trip, annual revenue of $2,000 per vessel per year suggest a relatively low level of effort in terms of the mere number of fishing trips.

On the basis of average revenue per trip, the $9,800 revenue threshold corresponding to a 1 percent cost-to-revenue ratio for compliance costs of $98 per year would only be exceeded for a vessel making fewer than 26 groundfish or 13 non groundfish trips, each year.

For these reasons, EPA expects that impacts to the commercial fishing sector are much less than estimated on the basis of revenue reported per vessel or per permit.

6.4 ISSUES AND UNCERTAINTIES

There is considerable uncertainty regarding the percentage of firms that may incur economic impacts above 1 percent or 3 percent of their annual revenue. This uncertainty largely stems from limitations of the data regarding the financial and operational characteristics of firms in the affected industries, and from compliance costs estimated to be incurred by these firms.

The number and percentage of firms estimated to incur economic impacts is based upon the firm number estimated from the MISLE database. EPA assumes that the Economic Census distribution of firms by revenue size is the same as the MISLE distribution of firms by revenue size. These assumptions may result in a distribution that differs from the actual distribution of affected firms.

There is also uncertainty surrounding EPA's assumption that the average number of vessels per firm is proportional to their revenue. EPA assumes that firms in the smallest revenue category have only one vessel, with the number of vessels operated by each firm growing proportionally to the firm revenue. These assumptions may result in underestimation or overestimation of the number of vessels per firm, and the underestimation or overestimation may vary by revenue size category. In instances where EPA underestimates the number of vessels per firm, market impacts may be underestimated. In instances where EPA overestimates the number of vessels per firm, market impacts may be overestimated. Overall, EPA expects that few large firms will incur material impacts as a result of sVGP compliance either because their revenue far exceeds their relative costs, or because these firms tend to operate vessels 79 feet or larger which are not subject to the sVGP but are instead covered by the VGP.

EPA assumed the same range of cost per vessel for all industry sectors, based on the best and worst case scenarios. There is uncertainty associated with this simplifying assumption, because some vessels may already be implementing certain practices and would therefore not incur additional costs as a result of the sVGP. Further, as described elsewhere in this document, even within the subset of vessels less than 79 feet, smaller vessels may have relatively lower compliance costs than larger vessels, and therefore would be less likely to be faced with the upper bound cost ($98) EPA estimated. Finally, given the relationship between vessel size and revenue, firms with lower revenue are more likely to be using smaller vessels. Incremental compliance costs may therefore be lower for some firms than estimated by simply multiplying the number of vessels times the extreme ends of the compliance costs estimates.

For each revenue bracket, EPA first assumed that firm revenues were equal to the average revenue in the bracket (or the midpoint when the average was not available). There is uncertainty associated with this simplifying

assumption, because calculating an average firm cost results in less variation compared to an alternative approach that simulates a distribution of firm revenues within revenue size ranges. EPA tested the impacts of assuming a distribution of revenue for firms in the fishing industry. The use of this alternative revenue distribution highlights that some of the smallest firms may, in fact, incur costs that exceed the cost-to-revenue thresholds indicating material impacts. Thus, while the analysis based on average revenue identified no firm with costs that exceed the 1 percent cost-to-revenue threshold, using statistics on per vessel revenue from Northeast and Alaska fisheries suggest that as many as 44 percent of active commercial fishing permit holders have annual revenue that are below the $9,800 necessary not to exceed the threshold for compliance costs of $98 per year.

Finally, in determining firm-level revenue, EPA relied on data available at the level of individual permits or vessels. Implicit in the firm-level revenue determination was the assumption that small firms hold single permits and operate a single vessel, and that the fishing activities constitute the only source of revenue for the firm. Also implicit is the assumption that entities reporting revenue have commercial fishing as their primary economic activity. Data on revenue per level of effort (e.g., per trip or per day) suggest that it is unlikely that firms or permit holders with revenue below about $10,000 per year have commercial fishing as their primary economic activity and further suggests that firms with vessels covered by the sVGP are unlikely to incur compliance costs that exceed 1 percent or 3 percent of their revenue.

6.5 DISCUSSION

The analysis results suggest that it compliance with the sVGP is unlikely to result in a significant number of firms in the commercial fishing industry incurring material economic impacts as a result of complying with the sVGP These results are subject to uncertainty in the revenue data for firms in this sector and on the number of firms that have vessels covered by the sVGP. Thus, on the basis of fishing permit revenue data, up to 14 percent of permit holders could incur material impact. According to EPA guidance, these results would suggest that compliance with sVGP requirements may impose costs that are significant for small businesses, and further, that the sVGP may also have substantial impacts given the large number of small businesses affected. However, other data on fishing revenue as a function of effort (per trip) for small vessels suggest that using the distribution of per vessel revenue tends to grossly overestimate impacts to firms for which commercial fishing is the primary economic activity, irrespective of the fact that such activity may be seasonal.

Even where the analysis suggests a relatively significant number of affected small firms, the findings follow in part from the structure of the affected industries since the vast majority of the firms (almost all firms) are small. The commercial fishing sector, in particular, is characterized by a large number of nonemployer firms, many of which operate only seasonally. The very large number of small operators means that the Permit can be expected to have some effect on small firms. The exact impacts on the profitability of these small businesses are difficult to quantify, however, due to limitations of the data. More detailed analyses would consider the degree to which firms may be able to pass-through incremental compliance costs to their customers, various measures of the financial health of affected entities, or compare the relative impacts on small versus large firms, but would require much more detailed data on operational and financial characteristics of firms.

Further, given the regulatory framework applicable to different types of vessels, EPA expects that compliance with sVGP requirements will not differentially affect the small firms in a way that would make them less competitive vis-à-vis larger firms in the same industry. In designing the sVGP, EPA purposefully limited the requirements to the minimum set necessary to accomplish water quality objectives set forth in the Clean Water Act (see *Section* 7 for a discussion of the benefits expected to follow from implementation of the sVGP). For example, the sVGP significantly streamlines requirements contained in the VGP, which addresses vessels 79 feet

or greater. Within the context of controlling discharges incidental to the operation of vessels, therefore, EPA has aimed to provide relief to small businesses within each industry that operates non-recreational vessels by setting separate requirements that are specifically targeted at the characteristics of small vessels and streamlining the administration of these requirements wherever possible.

7 BENEFITS

EPA expects that reductions in discharges incidental to the operation of small non-recreational vessels will benefit society in two broad categories, discussed below: (1) enhanced environmental quality from reduced loadings of several categories of pollutant (*Section 7.1*) and (2) reduced risk of invasive species introduction and spread (*Section 7.2*).

7.1 POLLUTANTS OF CONCERN FOUND IN VESSEL DISCHARGES

7.1.1 INTRODUCTION AND BACKGROUND

The Clean Water Act and its associated regulations have greatly improved the quality of the nation's waters over the past 40 years. Nevertheless, large portions of the United States' fresh and saline waters remain degraded by elevated concentrations of harmful pollutants. As summarized by EPA, 50 percent of assessed rivers and streams; 66 percent of assessed lakes, ponds, and reservoirs; 64 percent of assessed bays and estuaries; and 38 percent of coastal shorelines were classified as impaired for at least one of their designated uses (EPA, 2011).[37] Impairments of designated uses – the protection and propagation of fish, shellfish, and wildlife and the harvesting of aquatic life, among others – are associated with a variety of economic and ecological damages. The causes of impairment vary by waterbody, but commonly include pathogens, oxygen enrichment/oxygen depletion, nutrients, metals, turbidity, oil and grease, and nuisance exotic species. [38]

As detailed in EPA's 2010 vessels study, several of these causes have associated pollutants that have be found in discharges incidental to the normal operation of vessels subject to the sVGP. For example, EPA found significant concentration of nutrients in deck runoff, graywater, bilgewater, and fish hold tanks.

The sVGP contains provisions for reducing pollutant loadings incidental to vessel operation, either by minimizing the introduction of pollutants in the vessel effluents (e.g., use of environmental preferred cleaners or lubricants, good housekeeping practices), use of technologies to prevent or contain pollutant discharges, and regular inspection and monitoring to identify and address potential problems. In the section below, we describe the types of pollutants that may be found in vessel discharges and discuss how the sVGP requirements may help reduce loadings of these pollutants to waters of the U.S. and therefore generate potential benefits for aquatic ecosystems. These benefits will be likely to occur mostly in waterways receiving the greatest amount of vessel traffic.

7.1.2 POLLUTANTS COMMONLY FOUND IN VESSEL DISCHARGES

In its 2010 study characterizing discharges incidental to the operation of commercial fishing vessels and small non-recreational vessels, EPA grouped individual harmful constituents of vessel discharges into six broad

[37] States are responsible for assessing impairment of water bodies. States assessed 26 percent of rivers and streams; 42 percent of lakes, ponds, and reservoirs; 21 percent of bays and estuaries; and 4 percent of coastal shorelines in the reporting cycle summarized in this report (generally ranging from 2002 and 2010, depending on the state, with data for most states reflecting assessments completed as of 2008).

[38] The risk of introduction of ANS is discussed in the next section.

categories: classical pollutants[39]; nutrients; pathogens; metals; volatile and semivolatile organic compounds (VOCs and SVOCs); and nonylphenols (EPA, 2010). Many of the nine types of discharges covered by the sVGP are associated with one or more of these six types of pollutant categories, as summarized in *Table 7-1*. The characteristics of selected vessel discharge sources is summarized briefly in the following sections; a more detailed and comprehensive discussion of the pollutant loadings associated with vessel discharges can be found in EPA (2010).

Table 7-1: Pollutants Found in Discharges Incidental to the Normal Operations of Vessels Less than 79 Feet.

Type of Discharge	Classical Pollutants	Nutrients	Pathogens	Metals	VOCs and SVOCs	Nonylphenols
Bilgewater	•	•	•	•	•	•
Stern tube packing gland	•			•	•	•
Deck washdown	•	•	•[a]	•	•	•
Fish hold	•	•	•	•		
Fish hold cleaning effluent	•	•	•	•	•	
Graywater	•	•	•	•		•
Propulsion engine effluent				•	•	
Generator engine effluent				•	•	
Firemain system	•			•	•	
Vessel hull maintenance				•		

Source: EPA (2010)

[a] Fishing vessels only.

BILGEWATER

Depending on the ship design and function, bilge water may contain contaminants such as oil, fuel, graywater, detergents, solvents, chemicals, pitch and particulates. The volume of bilge water that accumulates during regular vessel operations depends on the vessel construction, size, precipitation, frequency of deck cleaning, amount of spray reaching the deck, accidental spills, integrity of piping systems, and the potential for condensate formation in below-deck areas. During the 2010 study, EPA estimated that small non-recreational vessels generate between 10 and 15 gallons per day of bilgewater.

In analyzing bilgewater collected on selected non-recreational vessels, EPA found oil and grease in all samples. Several metals were also present (e.g., aluminum, arsenic, barium, lead, iron, copper, zinc) either in a majority of samples, or in all samples. Several of these metals consistently measured at concentrations exceeding the most stringent NRWQC.

Current regulations require the use of oily-water separators prior to discharging bilgewater for all vessels weighing more than 400 tons, but do not apply to the smaller vessels addressed by the sVGP. Not all of the

[39] "Classical pollutants" include the following 14 pollutants or water quality indicators: temperature; conductivity; salinity; turbidity; dissolved oxygen; total suspended solids; biochemical oxygen demand; chemical oxygen demand; total organic carbon; oil and grease; pH; sulfide; and total residual chlorine.

vessels addressed in the sVGP, therefore, use an oil-water separator. The sVGP addresses pollution associated with bilgewater discharge by requiring either that the vessel operator visually monitor discharges from the oil-water separator, or remove oil that entered the bilge using absorbent material. Though these requirements will not eliminate all discharges of harmful pollutants via bilgewater, they will reduce the loads in areas with heavy vessel traffic that are in nearshore environments.

GRAYWATER

Untreated graywater, as defined in Section *3.1,* contains multiple constituents of concern, including pathogenic bacteria indicators, oil and grease, organic and inorganic compounds, nutrients, and metals (EPA, 2010). The same study highlighted the variability in graywater volumes discharged by different vessels, depending on the vessel type, size, trip duration, and number of crew members.

Under the new Permit, all vessels must minimize production of graywater while stationary in confined waters such as marinas or harbors. The Permit also recommends that vessel owners minimize discharges in areas that have heavy traffic or recreational use or marine sanctuary or other similar sensitive areas. Finally, the sVGP requires the use of biodegradable, phosphate free and non-toxic detergents, soaps or cleaners for any activity where these products may find their way to graywater. These practices will reduce harmful constituents of discharges. Phosphate-based soaps and detergents are a source of phosphorus, which is a limiting nutrient in freshwater systems.

ANTIFOULING HULL COATINGS

Antifouling hull coatings are specialized paints and other coatings intended to retard the growth of algae, weeds, and encrusting organisms such as barnacles and zebra mussels on the underwater portion of vessel hulls. Copper oxide is by far the most common of the metallic biocides used in more than 90 percent of approximately 180 antifouling hull systems (AFS) registered in California (Singhasemanon, 2008; cited in EPA, 2010). Biocides used in AFSs can be toxic to a range of aquatic organisms, not just to fouling organisms. Conventional copper-based AFSs fall into several general categories: copolymer or ablative paints and hard contact leaching paints. Each of these coating formulations can benefit from periodic hull cleaning to remove fouling growth, maintain a smooth surface, and improve the copper release, but underwater cleaning can be a source of pollution if not done carefully. Several studies summarized in EPA (2010) have documented the plume of dissolved copper release during hull cleaning and quantified AFS biocide loadings into marinas and closed embayments or basins.

Elevated copper levels affect the growth, development, feeding, reproduction, and survival of various life stages of fish, mussels, oysters, scallops, crustaceans, and sea urchins. They also change the types of phytoplankton that thrive in boat basins, and have sublethal effects on fish (e.g., hinder metabolic processes, reproduction, development, activity levels, and behavior).

By reducing the use of copper-based AFS where possible, and limiting the release of copper from existing systems, the sVGP practices will help reduce the adverse environmental impacts of AFS on the aquatic fauna and biota.

7.1.3 POLLUTANT IMPACTS

Vessel discharges contain a wide variety of pollutants with the potential to cause ecological and economic harm to aquatic species and their habitat. In the 2010 report, EPA summarized the potential impacts of vessel discharges, concluding that, while vessels may not be solely responsible for exceedances of aquatic life or human health

NRWQC, vessel discharges could nonetheless have significant local impacts in small waterbodies or in confined areas with little to no flushing.

OIL AND GREASE

Oil and grease are another known component of vessel discharges with potentially harmful impacts to humans and to aquatic life. Oil in vessel discharges may not exceed concentrations that may not be harmful, consistent with existing regulation under 40 CFR part 110. The Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), a United Nations body, found that voluntary vessel discharges account for less than 1 percent of vessel oil discharges into the marine environment (GESAMP, 2007). However, vessel discharges may still contain enough oil to do ecological damage, even if they meet existing concentration requirements and account for a small percentage of total oil discharges worldwide. Oils are highly toxic and carcinogenic, and may inhibit reproduction and cause organ damage or even mortality (AMSA, 2003). Additionally, oil can taint organisms that are consumed by humans, which is a potential source of adverse health impacts.

The sVGP seeks to minimize and reduce discharges of oil and grease from several sources, including during fueling, when emptying the bilge or in response to accidental spills. For bilgewater, for example, the permit requires the visual monitoring of the oily water separator effluent, if a separator is present, or the removal of accumulated oil using absorbent material prior to pumping, when the vessel is not equipped with an oil separator. The sVGP also requires the use of environmentally acceptable lubricants in selected applications where the lubricant may come in contact with water and except when technically infeasible, to reduce loading of harmful compounds into the aquatic environment.

METALS

Metals are a diverse group of pollutants, many of which are toxic to aquatic life and humans. Vessel discharges can contain a variety of metal constituents. For example, EPA's 2010 study found a total of 15 different metals in samples from selected vessel discharges, with copper and arsenic generally posing the greater threat to human health and aquatic life.

While some metals, including copper, nickel, and zinc, are known to be essential to organism function, many others, including thallium and arsenic, are non-essential or are known to have only adverse impacts. Even essential metals can do serious damage to organism function in sufficiently elevated concentrations. Adverse impacts can include impaired organ function; impaired reproduction and birth defects; and, at extreme concentrations, acute mortality. Additionally, through a process known as bioaccumulation, metals may not be fully eliminated from blood and tissues by natural processes, and may accumulate in predator organisms further up the food chain (EPA, 2007b). This process can result in adverse health impacts for humans, who may consume contaminated fish and mollusks.

The impacts of metals on any given ecosystem are difficult to predict, however, due to the relatively complicated circumstances by which they are available to organisms. Bioavailability of metals, and therefore impacts, varies by species of organism, as well as by climate and chemistry of a water body (John and Leventhal, 1996). Moreover, background levels of metals can vary substantially by location (EPA, 2007b).

Modeling of hypothetical harbors conducted by EPA showed potentially significant metal loadings coming from vessels. Environmental impacts from dissolved copper leaching from antifouling hull coatings have been well documented in low-flushing environments in harbors with large number of recreational vessels (EPA, 2010). Arsenic contained in vessel deck washdown or bilgewater can bioaccumulate throughout the food chain.

Practices required under the sVGP aim to reduce metal loadings for example by minimizing the introduction of contaminants into the discharge (e.g., minimizing debris, paint chips, or residue on deck) or encouraging the use of non-copper based paints.

NUTRIENTS

Nutrient pollution, including nitrogen and phosphorus, is a component of vessel discharges and a major source of water quality degradation throughout the United States (USGS, 1999). Though traditionally associated with agricultural runoff from fertilizer, sewage treatment facilities, and urban stormwater, a variety of other sources do exist, including graywater and bilgewater discharges from vessels.

Nutrient pollution is associated with a variety of negative environmental impacts, the most notable of which is eutrophication, which can lead to reduced levels of dissolved oxygen due to increased demand (sometimes to the extremes of hypoxia), reduced levels of light penetration and turbidity, and changes in the composition of aquatic flora and fauna (National Research Council, 2000).

The impacts of these water quality reductions on recreation and fishing can be significant, particularly in estuaries. For example, a 1989 study found that a hypothetical 20 percent reduction in nitrogen and phosphorus loading in the Chesapeake Bay would result in an increase in recreation worth $34.6 million (in 1984 dollars) from increased public beach usage (National Research Council, 2000). Nutrient pollution has also contributed to the decline of the Chesapeake crab fishery, due to its role in degrading underwater vegetation, which serves as an important habitat for post-larval crabs (Maryland DLS, 2005). While the contribution of vessels covered by the sVGP to nutrient pollution is hard to quantify, any reduction in nutrient loadings would contribute to decreasing their adverse impacts.

PATHOGENS

Pathogens are another important constituent of discharges from vessels, particularly in graywater. EPA's study of graywater discharges and in deck washdown (fishing vessels only) found elevated levels of pathogen indicator bacteria (EPA, 2010). Specific pathogen indicators found in graywater included *E. coli*, enterococci, and fecal coliforms. Elevated levels of these indicators, have been linked to a higher incidence of gastrointestinal illness in swimmers and are used to indicate potential fecal contamination at swimming beaches. Beach managers use pathogen indicators to issue advisories or close beaches when levels exceed the ambient recreational water quality standard, reducing the recreational value of impacted beaches.

OTHER POLLUTANTS WITH TOXIC EFFECTS

Other constituents of vessel discharges are known to have a broad array of adverse impacts on aquatic species and human health. For example, the 2010 study detected a total of 49 different volatile and semi-volatile organic compounds (VOCs and SVOCs) in sampled vessel discharges. Several of the compounds were detected at levels that exceed their respective human health criterion. EPA also detected endocrine disruptor nonylphenols in bilgewater, stern tube/packing gland, deck washdown, and graywater discharges.

VOCs and SVOCs, including most notably benzene, a known carcinogen, can cause a variety of adverse impacts on ecosystems, including fisheries, as well as on human health. Phthalates are known to interfere with reproductive health and liver and kidney function in both animals and humans (Sekizawa et al., 2003; DiGangi et al., 2002). Chlorine, though toxic to humans at high concentrations, is of much greater concern to aquatic species, which can experience respiratory problems, hemorrhaging, and acute mortality even at relatively low concentrations (EPA, 2007a).

Nonylphenols are manmade organic compounds that are used in a wide variety of applications, such as the manufacturing of detergents given their surfactant properties. They are synthetic estrogens and can mimic the natural vertebrate hormone estrogen and evoke an estrogen-like response, such as the disruption of male sexual development. They are highly toxic to fish, aquatic invertebrates, and aquatic plants. Both freshwater and saltwater invertebrates, plants and fish are sensitive to this category of chemicals and have demonstrated toxicity to it in varying degrees. Because they are persistent, they have the potential to bioaccumulate in the food chain.

OTHER NON-TOXIC POLLUTANTS

The category "other non-toxic pollutants" includes all non-conventional pollutants except fecal coliform (discussed in pathogens). As applied to vessel discharges, the category consists of multiple pollutants with disparate impacts. The most important types are biochemical oxygen demand (BOD) and chemical oxygen demand (COD), , which were elevated in the samples EPA collected of vessel bilgewater, deck washdown, fish hold, and graywater discharges. The two pollutants are measures of oxygen-demanding substances present in the discharges (e.g., organic matter) that can contribute to low dissolved oxygen levels in receiving waters. In particular, EPA found BOD levels in fish hold effluent and graywater that are comparable to those present in raw sewage (EPA, 2010).

7.1.4 BENEFITS OF REDUCING POLLUTANT DISCHARGES

Impacts of vessel discharges, and therefore the benefits of reducing pollutant loading in these discharges, may be particularly significant where the waters are already impaired, the number of vessels is large, or flushing is limited.

Many of the nation's busiest ports are considered to be impaired by a variety of pollutants found in vessel discharges. This includes hailing ports popular with small fishing vessels and other non-recreational vessels. For example, the ports of Boston, MA, Gloucester, MA, Houma, LA, Houston, TX, New York, NY, New Orleans, LA, and Seattle, WA are all listed as impaired in the EPA Waters database (see *Table 7-2*). Causes of impairments include toxic organics, pathogens, noxious aquatic plants, oil and grease, nutrients, and organic enrichment/oxygen depletion. The sVGP is expected to reduce discharges of nutrients, metals, oil, grease, toxics, and other pollutants in waters with high levels of vessel traffic.

Table 7-2: Impairment Status of the Top 20 Hailing Ports.

Port	Causes of Impairment
Boston, MA	Toxic organics, Pathogens, Noxious Aquatic Plants
Cordova, AK	None listed
Gloucester, MA	Pathogens
Homer, AK	None listed
Houma, LA	Total toxics, Oil and grease, Salinity/TDS/chlorides/sulfates, Toxic organics, Nutrients, Organic enrichment/oxygen depletion, Pathogens, Turbidity
Houston, TX (Houston Ship Channel)	PCBs, Dioxins, Total toxics, Pathogens, Mercury, Pesticides, Organic enrichment/oxygen depletion, Metals (other than mercury)
Juneau, AK	None listed
Ketchikan, AK	None listed
Key West, FL	None listed
Kodiak, AK	None listed
Miami, FL	None listed
New Orleans, LA	Pathogens
New York City, NY	Nitrogen, Organic enrichment/oxygen depletion, Cadmium, Mercury
Norfolk, VA	None listed
Petersburg, AK	None listed
Portland, OR	None listed
San Diego, CA	Metals (other than mercury), Total toxics
San Francisco, CA (San Francisco Bay)	Dioxins, PCBs, Pesticides, Mercury, Metals (other than mercury), Nuisance exotic species
Seattle, WA	PAHs, Pathogens, pH
Sitka, AK	None listed

Source: Battelle (2007); EPA Waters database (accessed May 13, 2011)

7.2 AQUATIC NUISANCE SPECIES IMPACTS

7.2.1 INTRODUCTION AND BACKGROUND

Introductions of non-indigenous species have occurred in the United States for centuries, with more than 50,000 total non-native species thought to be successfully established with reproducing populations in U.S. territory (Pimentel et al., 2005). Scientists and governments have long recognized the economic and ecological damages associated with land-based invaders, but attention turned toward aquatic nuisance species (ANS) in the 1980s, when the extent of the zebra mussel invasions in the Great Lakes region first became a serious problem (Ruiz and Reid, 2007). ANS invasions have caused tremendous economic and ecological damages to critical coastal and inland waters throughout the United States.

ANS may be introduced through a variety of vectors, including intentional introductions, escape from a confined environment, or transport on the hull of a vessel or in ballast water and sediment from ballast tanks. One of the major known vectors for ANS introduction is through the ballast water tanks of commercial vessels, although transport of organisms from one waterbody to another may also occur when organisms attach themselves to the vessel hull.

The U.S. Coast Guard's 2004 Rulemaking for Mandatory Ballast Water Management (codified in 33 CFR 151) mandated open ocean ballast water exchange for ships traveling outside the 200-nautical mile exclusive economic

zone (EEZ) of the United States. EPA's current Vessel General Permit contains stringent ballast water exchange requirements for non-recreational vessels larger than 79 feet.

The inspection provisions of the sVGP will help further reduce the possibility of ANS introductions or their spread. Specifically, the Permit requires a visual inspection of the visible areas of the vessel to detect any attached or stowaway living organisms and their removal as applicable.

7.2.2 ANS IMPACTS

ANS invasions are a persistent problem in U.S. coastal and inland waters. ANS invade U.S. waters through a number of dispersal mechanisms including releases from fisheries; research and education facilities; restoration efforts; public aquaria and the aquarium pet industry; and by being attached to or within ships, drydocks, amphibious planes, floating marine debris, drilling platforms, navigation buoys and marine floats, canals, and recreational equipment (Carlton et al., 2003).

Though no reliable and comprehensive estimates of total ANS introductions nationwide exist, case studies of several major bodies of water across the country, as summarized in *Table 7-3,* provide a sense of the extent of the problem.

Table 7-3: Estimates of Aquatic Nuisance Species in Several Major Water Systems.

Region	Estimated Rate of Invasion[a]	Estimated Total Invasions to Date[b]
Great Lakes	Once every 28 weeks[c]	162
Mississippi River System	Unknown	100
San Francisco Bay	Once every 24 weeks[d]	212
Lower Columbia River Basin	Once every 5 months[e]	81
Gulf of Mexico	Unknown	579

[a] Ruiz and Reid (2007) suggest that these figures may not reliably represent the true rate of introduction, as they are based on discovery data, which may not always track with the underlying rate of introduction.

[b] All figures in this column are taken from USCG (2004b).

[c] NOAA (2007).

[d] Cohen and Carlton (1995).

[e] Sytsma et al. (2004).

The total costs associated with ANS in the United States are staggering. A study suggests that expenditures on control alone for ANS in the United States total approximately $9 billion annually (Pimentel et al., 2005). A broad range of damages are associated with any introduction of a given type of species, summarized in *Table 7-4.*

Table 7-4: Estimates of Aquatic Nuisance Species Damages by Type of Species.

Type of Species	Range of Potential Damages per Invasion per Year (Million 2010$)
Fish	0 – 161[a]
Mollusks	0 – 6,415[b]
Non-Mollusk Invertebrates	0 – 23.8[c]
Plants	0 – 36.9[d]
Pathogens	0 – 0.764[e]

[a] Based on Ruffe (Leigh, 1998), adjusted to 2010$ using CPI.
[b] Based on Zebra Mussel (Pimentel et al., 1999), adjusted to 2010$ using CPI.
[c] Based on European Green Crab (EPA, 2008a), adjusted to 2010$ using CPI.
[d] Based on hydrilla (OTA, 1993), adjusted to 2010$ using CPI.
[e] Based on an outbreak of epidemic cholera (Lovell and Drake, 2007), adjusted to 2010$ using CPI.

Although some species cause no economic damage, others may cause hundreds of millions of dollars in damages. The majority of these damages may be broken down into six broad categories of impacts, which are described in the subsequent subsections.[40]

COMMERCIAL AND RECREATIONAL FISHERIES

As noted above, the introduction of ANS can cause the imbalance of native ecosystems. ANS pose an especially serious risk to commercial and recreational fisheries, which like other aquatic resources could be devastated by ANS (IDNR, 2003). Selected examples of ANS impacts on fisheries include the European green crab and the zebra mussel, described below.

- ***European Green Crab:*** The most likely mode of the initial European green crab introduction on the East Coast of North America was ship fouling (Cohen et al., 1995). Other possible pathways of introduction include ballast water and solid ballast. Grosholz (2006) and Cohen (1997) believe that incidental transport with commercial fishery products is the most likely vector for the initial introduction of C. maenas to the West Coast. The annual estimated economic damages from European green crab predation to commercial and recreational shellfisheries and eelgrass restoration efforts range from $18.6 to $22.6 million per year in the United States (EPA, 2008a).
- ***Zebra Mussel:*** An invasion of zebra mussels, which are native to the Caspian Sea and were introduced to U.S. waters in ballast water, has led to a halt in the $3 billion dollar Mississippi River shelling industry (Randall, 2001).

Additionally, while vectors for several recent ANS introductions are believed to be ballast water, even vessels without ballast water on board may facilitate the spread of ANS to other waterbodies. Visual inspection of vessel hull and removal of attached or stowaway organisms can therefore be an effective way to curb the progression of ANS and their associated damage to fisheries.

[40] Portions of a previous analysis of benefits associated with ANS introduction reductions are incorporated into this analysis (Abt Associates Inc., 2005).

OTHER WATER-BASED RECREATION AND TOURISM

ANS have also had adverse impacts on recreation and tourism nationwide by damaging water quality and flow. Two invasive plants, hydrilla and water lettuce, have caused significant damages in U.S. waters. Both clog the water's surface, blocking boating and swimming, impeding water flow, and disrupting plant and animal communities. Florida spends an estimated $1 million or more annually to control water lettuce, and the rest of the Eastern U.S. states spend approximately $100,000 annually (Van Driesche et al., 2002). Studies of two lakes in Florida affected by hydrilla found that degradation caused by the hydrilla cost the state $11 million in lost recreation expenditures (Pimentel et al., 1999).[41]

Invasive mollusks such as zebra mussels can also adversely affect a number of recreational activities, including boating and swimming. Zebra mussels often cover shorelines with sharp-edged shells and rotting mussel flesh, which can diminish interest in visiting infested beaches. Biofouling can also be a deterrent to recreational boaters who would rather avoid zebra mussel fouling and the resulting necessity of extensive vessel cleaning (USACE, 2002). A study by Vilaplana and Hushak (1994) estimated that incremental annual costs to boat owners in the Great Lakes related to the mussel included $94 for protective anti-fouling paints, $171 for additional maintenance, and $207 for insurance.

BIODIVERSITY AND ECOSYSTEMS

Introductions of ANS can drastically alter virtually every characteristic of an aquatic ecosystem. ANS can affect the "composition, density, and interactions of native species" that can then cause "significant changes to the ecosystem, such as alterations to the food webs, nutrient dynamics and biodiversity" (IDNR, 2003). Ecosystems provide a variety of services, including water quality maintenance, detoxification and decomposition of waste, climate stabilization, mitigation of natural disaster impacts, and a source of income. Significant instances of adverse ecosystem impact include, most notably, the introduction of the zebra mussel in the Great Lakes region. The mussels achieved densities as high as 700,000 per square meter, which led to a much greater filtration rate of particulate matter, resulting in much lower turbidity (Griffiths et al., 1991; MacIsaac et al., 1995). This in turn led to much greater filtration of light through the water column, which affected plant viability and substantially increased competition for food for indigenous mollusks. [42] Another example is *Carijoa riisei*, or snowflake coral, an invasive coral species that spreads through vessel fouling and is threatening the ecosystem stability of the ecologically sensitive Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NOAA, 2004a; Toonen, 2005). It is a threat to the native bottom dwelling community and to black coral, which a local industry valued at $30 million harvests and uses to make jewelry.

THREATENED AND ENDANGERED SPECIES

Invasions have had especially adverse impacts on threatened and endangered species by predation, alteration of habitat, or further competition for limited resources. It is estimated that non-indigenous species are a contributing factor to the endangered status of 70 percent of listed fish species, and more than half of combined endangered and threatened listings (OTA, 1993). They are also estimated to have contributed to 68 percent of fish extinctions in the last 100 years (Larson and Sytsma, 2006).

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[41] This cost may have an adverse impact locally, but because the money is still available to be spent elsewhere, this adverse impact does not represent a true net welfare loss. [Good point!]

[42] Other examples include the introduction of the round goby and the European Ruffe in the Great Lakes via ballast water.

DAMAGE TO INFRASTRUCTURE

Industrial facilities, such as those that purify water, generate electricity, and manufacture goods, depend on water intake structures to perform their services. These structures can often be adversely affected by ANS.

So far, zebra mussels have been the most damaging ANS introduced into U.S. fresh waters, causing particularly severe problems with water intake structures (USACE, 2002). Zebra mussels attach to surfaces of water intake structures, navigation dams, pumping stations, and gears, often making them inoperable, which inconveniences the public and costs industry significant financial losses and damages (USACE, 2002).

Hushak (1996) reports on the results of 398 surveys of Great Lakes users with lake water intake structures from 1989 to 1994 for private and public utilities, municipal water facilities, and industrial users. Extrapolating the results of this survey to all facilities in the Great Lakes yielded total monitoring and control costs of $120 million from 1989 to 1994 with an average cost of $30 million annually (Park and Hushak, 1998). Another study done in 1995 of the economic impact of zebra mussels (O'Neill, 1997) found that the total costs of zebra mussels control and monitoring were $69 million, with a mean cost of $205,570 per facility. The study results also showed that total annual expenses rose from $234,140 in 1989 to $17,751,000 in 1995 as the range of mussels increased (O'Neill, 1997).

Another invasive bivalve species, the Asian clam, is estimated to have caused fouling damage that cost the nuclear industry about $1 billion per year in the early 1980s (OTA, 1993). Two other invasive bivalves, the brown mussel and the green mussel, have also caused fouling damages in the Gulf Coast region and Tampa Bay, respectively, where each has become established, although the total economic value of the damages is not known (Benson et al., 2002; GSMFC, 2003).

Finally, invasive plant species such as hydrilla and water hyacinth can disrupt water flow in irrigation canals and in utility cooling reservoirs. Annual expenditures on aquatic weed control in the United States, much of which is spent on ANS weeds specifically, are estimated at $110 million (Pimentel et al., 2005).

7.2.3 BENEFITS OF REDUCING ANS INTRODUCTIONS

The evidence presented in *Section 7.2.3* demonstrates that introductions of ANS are associated with significant detrimental impacts throughout the United States. The ANS inspection provisions of EPA's sVGP, to the degree that they fill a gap in the existing ANS prevention practices, can therefore be expected to generate benefits by reducing the risk of such damages in the future. Benefits would include the prevention of damages to fisheries, tourism, and recreation, of damages to infrastructure, and of adverse human health impacts, as well as prevention of further stresses on native biodiversity and ecosystems.

The issue of ANS invasions and their impacts presents unique challenges for the estimation of the benefits associated with this Permit. Although overwater transport is one of the pathways for the spread of invasive species, estimating changes in risk of introduction or further spreading of invasive species from the Permit requirements is not feasible due to the lack of data on rates of invasive species introduction or spread associated with attached or stowaway organisms. Moreover, because the type of species introduced in the future is unknown and the range of potential economic impacts associated with each species type is very large, estimating the monetary value of benefits from preventing or mitigating future invasions with a reasonable degree of certainty would not be possible.

- ***Commercial and recreational fisheries***. A reduction in the number of ANS introductions due to hull maintenance requirements may prevent significant future damages to commercial and recreational fisheries that play a critical role in the U.S. economy. In 2009, 7.9 billion pounds of fish and shellfish

were landed by U.S. commercial fishermen at U.S. ports, and were valued at $3.9 billion (NMFS, 2010). An additional 29.9 million anglers aged 16 and older spent an average of 17 days fishing in 2006, spending more than $40 billion dollars on trips, equipment, licenses, and other costs (USDOI, 2007). Leigh (1998) estimated the annual reduction in value of yellow perch, walleye, and whitefish fisheries due to ruffe invasion under moderate scenario assumptions to be $119 million (in 1998 dollars; $159 million (2010$) inflated using the Consumer Price Index (CPI)).

- ***Other Water-Based Recreation and Tourism***. Another source of potential benefits from the reduction of ANS introductions under the Permit will be the prevention of damages to valuable recreation and tourism sites. A report by NOAA (2004b) estimated the annual revenue associated with coastal tourism in the United States to be $54 billion, and found that beaches are the most popular tourist destinations in the United States. One invasive plant species alone, hydrilla, is associated with $14.5 million annually in control costs, and reduces lake recreation on two Florida lakes alone by $11 million in years when hydrilla covers the lakes (Pimentel et al., 1999). Since data are limited on the impacts of invasive species on recreation and tourism in ecosystems for which estimated rates of invasion exist, it is not possible to calculate the level of expected benefits for other water-based recreation and tourism. However, EPA projects that there will be some incremental benefits.
- ***Biodiversity and Ecosystems.*** Additional significant benefits from the Permit will accrue to biodiversity and ecosystems. As detailed in *Section 7.2,* ANS are associated with substantial adverse impacts on the composition of ecosystems and the biodiversity therein. The quantification of biodiversity benefits will not be attempted in this analysis due to the great deal of uncertainty surrounding the impact of a single ANS introduction on a given ecosystem relative to other factors, as well as the difficulty. However, potential benefits in the form of preservation of habitat and species are likely.
- ***Threatened and Endangered Species***. The Permit requirements, by reducing the impacts of invasive species introductions or spread on threatened and endangered species, will have benefits in terms of prevention of reduction in species population and species extinction. Total federal spending nationwide on programs related to the Endangered Species Act for 2008, the most recent year for which data are available, was nearly $1 billion, and state spending was more than $115 million (Congressional Research Service, 2010). As mentioned above, ANS are considered likely contributors to the threatened or endangered status of 70 percent of listed fish species (Larson and Sytsma, 2006). Combined federal and state expenditures per listed species of fish in 2004, the most recent year with this detailed information, ranged from $25,000 to $1.09 million (USFWS, 2005). It is not possible to calculate a range of benefits to threatened and endangered species associated with EPA's Permit requirements, due to the lack of research linking specific invasions with quantifiable impacts on particular species. However, it is likely that some proportion of potential future expenditures on endangered and threatened fish, as well as expenditures on other aquatic endangered species, would be averted by reduced ANS introductions or spreading under the Permit requirements.
- ***Damage to Infrastructure***. Another benefit of the sVGP requirements will result from averting damages to infrastructure by invasive species of plants and mollusks. Fouling by species such as the Asian clam, zebra mussel, and hydrilla has caused substantial economic damage to a variety of municipal and industrial entities in the past. Most of this damage takes the form of clogging water intake structures and disrupting the flow of water. One study estimated fouling damage to water intake infrastructure by zebra mussels for the year 2000 to be $5 billion (Khalanski (1997), and cited in Pimentel et al. (1999); $6.1 billion in 2007$ using CPI).

- ***Human Health***. Estimating expected human health benefits of EPA's Permit is not feasible due to very limited data on the rates of non-endemic pathogen invasions and the human health effects of these pathogens. Nevertheless, the Permit provisions are likely to reduce the probability of introduction of harmful exotic pathogens and thus are expected to benefit human health.

The hull visual inspection requirements established in the sVGP are designed to directly address the likelihood of future ANS invasions and their ultimate spread across waterbodies. The categories of potential damages from such ANS invasions have been discussed above, and studies referenced as to the potential magnitude of these damages for each. To the degree that these damage estimates provide an indicator of the likely payback that can be anticipated from reducing ANS invasions or spread, EPA believes the benefits of this Permit could be expected to be significant. However, the complexity of the ANS issue,[43] the wide range and varied nature of impacts these invasions can cause, and the great breadth of the scope of this Permit prohibit EPA from developing a quantified estimate of these benefits.

7.3 SUMMARY OF BENEFITS

The evidence presented in the pollutant impacts section demonstrates that vessel discharges, particularly ANS spread, are associated with significant detrimental impacts throughout the United States. Controls on specific discharges, as well as general housekeeping requirements of the Permit, can be expected to generate benefits through reducing the risk of damages in the future and making water quality improvements in already-impaired waters. Monetized benefits will include the prevention of fishery closures and of adverse human health impacts, as well as increased opportunities for recreation. Non-monetized benefits will include prevention of further stresses on biodiversity and ecosystems.

Though the magnitude of benefits is not calculable, *Table 7-5*summarizes the categories of potential benefits resulting from compliance with sVGP requirements.

Table 7-5. Benefits of Reducing the Impacts of Vessel Discharges.

Type of Benefit	ANS	Nutrients	Pathogens	Oil & Grease	Metals	Other Toxics	Other Non-Toxics
Human Health	•	•	•	•	•	•	
Biodiversity	•	•		•	•	•	•
Ecosystem Function	•	•		•	•	•	•
Improved Fishery Conditions	•	•	•		•	•	•
Increased Opportunities for Recreation	•	•	•			•	

[43] This includes characterizing the probability of any unregulated or non-compliant vessel to introduce or spread an ANS to a waterbody and the marginal effect of the regulation in preventing damage from ANS introduction or spread.

REFERENCES

15 CFR § 922. National Marine Sanctuary Program Regulations. Available at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title15/15cfr922_main_02.tpl Accessed 4 May 2011.

33 CFR 121.201. Small Business Size Regulations. Available at http://frwebgate.access.gpo.gov/cgi-bin/get-cfr.cgi. Accessed 4 May 2011.

33 CFR 151. Vessels Carrying Oil, Noxious Liquid Substances, Garbage, Municipal or Commercial Waste, and Ballast Water. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_07/33cfr151_07.html. Accessed 4 May 2011.

33 CFR 155. Oil or Hazardous Material Pollution Prevention Regulations for Vessels. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_07/33cfr155_07.html. Accessed 4 May 2011.

33 CFR 159.309. Marine Sanitation Devices: Limitations on Discharge of Treated Sewage or Graywater. Available at: http://a257.g.akamaitech.net/7/257/2422/11sep20071500/edocket.access.gpo.gov/cfr_2007/julqtr/33cfr159.309.htm. Accessed 4 May 2011.

40 CFR 110. Discharge of Oil. Available at http://www.epa.gov/oem/docs/oil/spcc/guidance/B_40CFR110.pdf. Accessed 4 May 2011.

40 CFR 122. EPA Administered Permit Programs: The National Pollutant Discharge Elimination System. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_07/40cfr122_07.html. Accessed 4 May 2011.

70 CFR 168. Ballast Water Management for Vessels Entering the Great Lakes That Declare No Ballast Onboard. Available at: http://www.uscg.mil/hq/g-m/mso/docs/nobob_policy_fr.pdf. Accessed 4 May 2011.

5 USC § 605(b). Regulatory Flexibility Act: Avoidance of Duplicative or Unnecessary Analyses. Accessed Available at http://www.archives.gov/federal-register/laws/regulatory-flexibility/605.html. Accessed 4 May 2011.

33 U.S.C. §§ 1321 Oil and Hazardous Substance Liability. Available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=browse_usc&docid=Cite:+33USC1321

33 USC § 2401 et seq. Organotin Anti-fouling Paint Control Act. Available at http://www.access.gpo.gov/uscode/title33/chapter37_.html. Accessed 4 May 2011.

Alaska Commercial Fisheries Entry Commission. 2011. Quartile Downloadable Data. Available at http://www.cfec.state.ak.us/fishery_statistics/earnings.htm. Accessed May 23, 2011.

Cape International, Inc and Nuka Research and Planning, LLC. 2006. Cook Inlet Vessel Traffic Study: Report to Cook Inlet Regional Citizens Advisory Council. December 2006. Available at: http://www.circac.org/documents/pdf/props/CI_VesselTrafficStudy_Final_Mar07.pdf

Congressional Research Service. 2010. The Endangered Species Act (ESA) in the 111th Congress: Conflicting Values and Difficult Choices.7-5700. July 23, 2010.

Dun & Bradstreet. 2006. D&B's Million Dollar Databases. Available at: http://mddi.dnb.com/mddi/. Accessed January 2006.

Food and Agriculture Organization. 1976. Codex Alimentarius, Volume 9, Recommended International Code of Practice for Fresh Fish. CAC/RCP 9-1976.

Kitts, Andrew. 2010. Measuring Total Fuel Use in Northeast U.S. Commercial Fisheries. NOAA Fisheries Services, Northeast Fisheries Science Center. Presented at: Enery use in Fisheries: Improving Efficiency and Technological Innovations from a Global Perspective, November 14-17, 2010. Seattle, WA. Available at: http://www.energyfish.nmfs.noaa.gov/proceedings/metrics_1_presentation_4.pdf

Mason, Don. Personal Communication. Fisheries Management Specialist and Compliance Liason at Northeast NOAA Office. 2011. May 13 2011.

National Oceanic and Atmospheric Administration (NOAA). 2008. Fisheries of the United States: 2007. National Marine Fisheries Service, Office of Science and Technology. Silver Spring, Maryland, July 2006. Available at: http://www.st.nmfs.noaa.gov/st1/fus/fus07/01_intro2007.pdf

National Oceanic and Atmospheric Administration (NOAA). 2010. *Fisheries of the United States, 2009*. Silver Spring, MD: National Marine Fisheries Service (NMFS). http://www.st.nmfs.noaa.gov/st1/fus/fus09/highlight2009.pdf

National Oceanic and Atmospheric Administration (NOAA). 2011a. *Annual Commercial Landing Statistics: 2009 All States by State*. Silver Spring, MD: National Marine Fisheries Service (NMFS). Updated 6 August 2007. Accessed 4 May 2011. http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html

National Oceanic and Atmospheric Administration (NOAA). 2011b. Interim Report for Fishing Year 2010 on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2010 – January 2011). Northeast Fisheries Science Center Reference Document 11-07

Office of Management and Budget (OMB). 2009. Update to Circular A-4: Regulatory Analysis.

Quinn, F.H. 2002. The Potential Impacts of Climate Change on Great Lakes Transportation. In: The Potential Impacts of Climate Change on Transportation, pp. 115-124. Federal Research Partnership Workshop October 1-2, 2002. DOT Center for Climate Change and Environmental Forecasting. Available at http://climate.dot.gov/documents/workshop1002/workshop.pdf

Reference for Business. 2007a. "SIC 0912-Finfish." Encyclopedia of American Industries. Accessed January 24, 2008. Available at http://www.referenceforbusiness.com/industries/Agriculture-Forestry-Fishing/Finfish.html.

Reference for Business. 2007b. "SIC 0913-Shellfish." Encyclopedia of American Industries. Accessed January 24, 2008. Available at http://www.referenceforbusiness.com/industries/Agriculture-Forestry-Fishing/Shellfish.html.

Reference for Business. 2007c. "SIC 4482-Ferries." Encyclopedia of American Industries. Accessed January 23, 2008. Available at http://www.referenceforbusiness.com/industries/Transportation-Communications-Utilities/Ferries.html.

Reference for Business. 2007d. "SIC 4489-Water Transportation of Passengers, not Elsewhere Classified." *Encyclopedia of American Industries*. Accessed January 23, 2008. Available at http://www.referenceforbusiness.com/industries/Transportation-Communications-Utilities/Water-Transportation-Passengers-Elsewhere-Classified.html

Reference for Business. 2007e. "SIC 4491-Marine Cargo Handling." Encyclopedia of American Industries. Accessed January 23, 2008. Available at http://www.referenceforbusiness.com/industries/Transportation-Communications-Utilities/Marine-Cargo-Handling.html.

Reference for Business. 2007f. "SIC 4499-Water Transportation Services, not Elsewhere Classified." Encyclopedia of American Industries. Accessed January 23, 2008. Available at http://www.referenceforbusiness.com/industries/Transportation-Communications-Utilities/Water-Transportation-Services-Elsewhere-Classified.html.

Reference for Business. 2007g. "SIC 4492-Towing and Tugboat Services/" Encyclopedia of American Industries. Accessed May 17, 2011. Available at: http://www.referenceforbusiness.com/industries/Transportation-Communications-Utilities/Towing-Tugboat-Services.html

ReferenceUSA. 2006. Business Database. Available at: www.referenceusa.com. Accessed Jan./Feb. 2006.

Samples, K. C. 1983. An economic appraisal of sail-assisted commercial fishing vessels in Hawaiian waters. Mar. Fish. Rev. 45:(7–9). 50–55. Available at: http://spo.nmfs.noaa.gov/mfr457-9/mfr457-97.pdf

Transportation Institute. "Industry Profile." Accessed January 23, 2008. Available at http://www.trans-inst.org/1.html.

Tyedmers, P.H., R. Watston and D. Pauly. 2005. Fueling Global Fishing Fleets. Ambio 34(8): 635-638. Available at http://www.seaaroundus.org/ecosystemsmaps/images/fuelingfleets.pdf

U.S. Army Corps of Engineers (USACE). 2009. Waterborne Commerce of the United States, 2009, Part 5 National Summaries. Institute for Water Resources. 2009. Available at http://www.ndc.iwr.usace.army.mil//wcsc/pdf/wcusnatl09.pdf

U.S. Bureau of Economic Analysis (US BEA). 2011a. Table 2.1. Personal Income and Its Disposition. Accessed 10 May 2011. Updated 28 April 2011. <http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=58&Freq=Qtr&FirstYear=2009&LastYear=2011>

U.S. Bureau of Economic Analysis (US BEA). 2011b. GDP and the National Income and Product Account (NIPA) Historical Tables. Available electronically at: http://bea.gov/national/index.htm#gdp

U.S. Bureau of Labor Statistics (U.S. BLS). 2011. Employment Cost Index: Historical Listing Current-dollar: March 2001-March 2011. Available at: ftp://ftp.bls.gov/pub/suppl/ECI.ECHISTRYNAICS.TXTAvailable at: ftp://ftp.bls.gov/pub/suppl/ECI.ECHISTRYNAICS.TXT

U.S. Census Bureau. 2002a. 2002 County Business Patterns for the United States. Available at http://www.census.gov/epcd/cbp/view/us02.txt.

U.S. Census Bureau. 2002b. 2002 Economic Census. Available at http://www.census.gov/econ/census02/.

U.S. Census Bureau. 2007a. 2007 Economic Census. Available at http://www.census.gov/econ/census07/

U.S. Census Bureau 2007b. County Business Patterns for the United States. Available at http://www.census.gov/econ/cbp/.

U.S. Census Bureau, 2010. Nonemployer Statistics for 2008. Available at http://www.census.gov/econ/nonemployer/ (accessed May 24, 2011).

U.S. Coast Guard. 2008. *Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters*. Preliminary Regulatory Analysis and Initial Regulatory Flexibility Analysis, USCG-2001-10486. June 2008

U.S. Coast Guard. 2009. Marine Information for Safety and Law Enforcement (MISLE). Available at http://www.uscg.mil/hq/cg5/msl/

U.S. Commission on Ocean Policy. 2004. An Ocean Blue Print for the 21st Century, Chapter 13: Supporting Marine Commerce and Transportation , Final Report of the U.S. Commission on Ocean Policy – Pre-Publication Copy. Washington, D.C., 2004 ISBN#0-9769462-0-X. Available at http://www.oceancommission.gov/documents/prepub_report/chapter13.pdf

U.S. Environmental Protection Agency (U.S. EPA). 2008. Economic and Benefits Analysis of the Final Vessel General Permit (VGP). Office of Wastewater Management. December 18, 2008.

U.S. Environmental Protection Agency (U.S. EPA). 2010a. Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (VGP), Version November 2010.

U.S. Environmental Protection Agency (U.S. EPA). 2010b. Report to Congress: Study of Discharges Incidental to the Normal Operation of Commercial Fishing Vessels and Other Non-Recreational Vessels Less than 79 Feet. Office of Water, Washington, D.C. August 2010. EPA 833-R-10-005. Available at http://www.epa.gov/npdes/pubs/vesselsreporttocongress_all_final.pdf

U.S. Small Business Administration. 2007a. U.S. Dynamic data, by births, deaths, growth, and decline, 1998-2006. Firm Size Data. Available at: http://archive.sba.gov/advo/research/dyn_us_n4.txt

U.S. Small Business Administration. 2007b. Statistics of Small Businesses, Classified by Employment Size of the Firm, 2003-2007. Available at: http://archive.sba.gov/advo/research/us03_07n02.txt

U.S. Small Business Administration. 2010. Tables of Small Business Size Standards Matched to North American Industry Classification System Codes. Available at http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf